

UPPER NORTH SANTIAM

(U. N. SANTIAM)

WATERSHED ANALYSIS

WILLAMETTE NATIONAL FOREST

Detroit Ranger District

August 1995

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INTRODUCTION

The Upper North Santiam watershed covers approximately 40 percent of the Detroit Ranger District. This watershed has a high variety and intensity of use, and a wide range of habitats created by processes that still influence those habitats. Major demands on this watershed include:

- Producing forest commodities
- Protecting, maintaining, and restoring a network of late successional systems
- Providing diverse recreational experiences
- Providing access to a variety of uses while protecting resources
- Maintaining high quality and quantities of water
- Restoring anadromous fisheries

The National Forest portion of the Upper North Santiam watershed was analyzed in a watershed assessment in February 1994 for the 1994 Watershed Restoration/Jobs in the Woods Program. The current analysis will use the 1994 watershed assessment as a basis for further analysis. The Federal Agency Guide for Pilot Watershed Analysis (version 1.2) and the draft revised guide for Watershed analysis (version 2.1) provided guidance to this process. The scope of this watershed analysis is to:

- Provide a general understanding of the ecological conditions and processes working within this watershed, and determine recreational use patterns and trends.
- Prioritize areas for a range of projects from watershed restoration to vegetation treatments that enhance succession, to direct commodity outputs.
- Evaluate riparian reserve requirements.
- Provide information to develop a natural fire management plan for the wilderness.
- Support a Late Successional Reserve (LSR) assessment.
- Direct future access and travel management decisions.
- Evaluate vegetation treatments, i.e., timber stand improvement.

CHARACTERIZATION

Location:

The Upper North Santiam Watershed is located in northeastern Linn and eastern Marion counties, Oregon. The eastern border follows the Cascade Crest. The watershed is part of the headwaters of the North Santiam River Subbasin which is part of the Willamette Basin within the Columbia River System (see map 1).

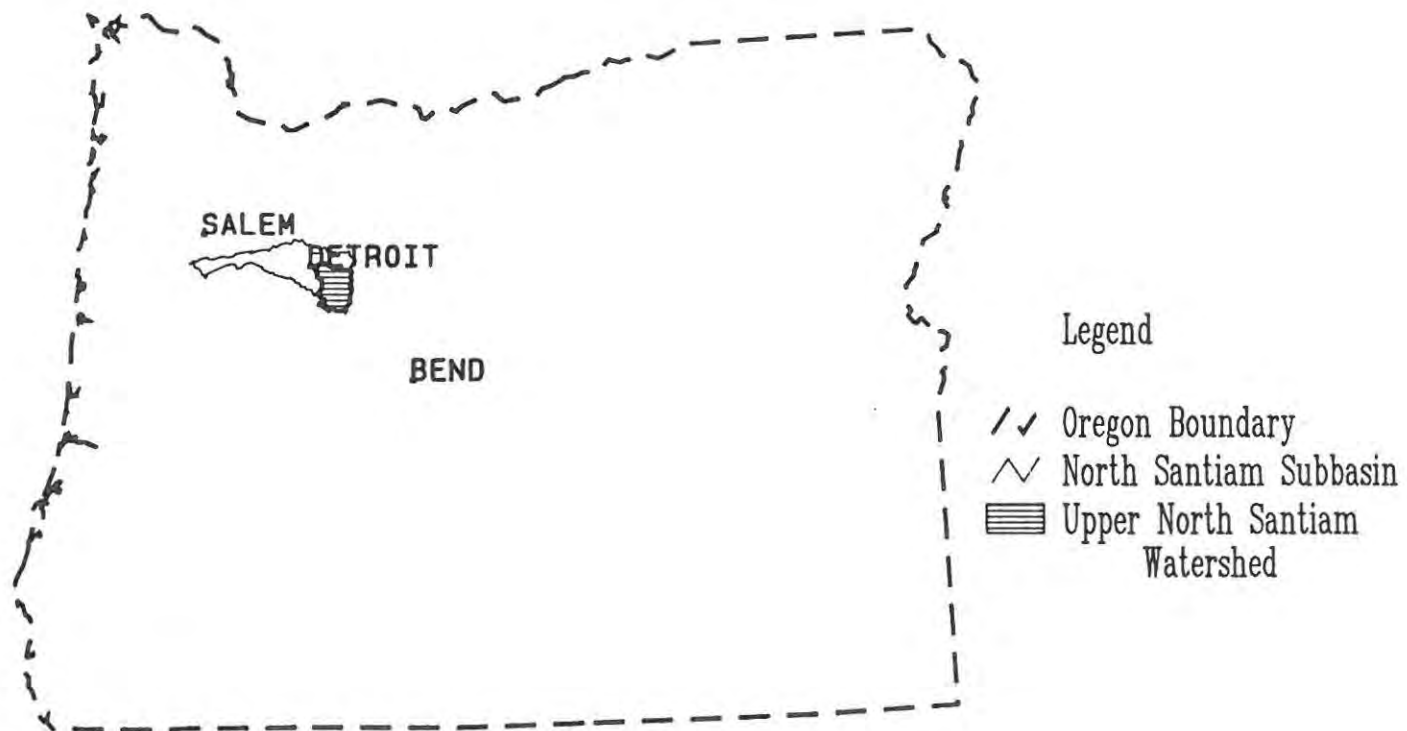
Dominant Features:

The Upper North Santiam watershed lies within close proximity of major population centers within the Willamette Valley and Central Oregon. Heavily traveled State Highway 22 bisects the watershed, parallels the North Santiam River, and is a major east/west corridor linking these population centers. The highway is used by more than 620,000 vehicles each year (see Transportation Report). This corridor is a major viewshed on the Willamette National Forest and is valued for its scenic qualities, developed campgrounds, and easy accessibility to numerous dispersed sites.

Idanha and unincorporated Marion Forks are the only towns that lie within the boundary of this watershed. The Marion Forks fish hatchery, the Marion Forks summer homes, Camp Pioneer, Green Veneer Mill and Forest Service campgrounds are other important facilities within the watershed. Other developments include municipal water facilities, buried transmission lines, log storage areas, and rock sources. Some facilities, although closed, still have effects in localized areas. For example, the recent closure of the Idanha landfill has led to an increase in garbage dumping on Federal lands.

This watershed has a wide variety of habitats due to the wide range of physical conditions. Elevations range from approximately 1,700 feet near the town of Idanha to 7,800 feet at Three Finger Jack to the south, 10,500 feet at Mount Jefferson to the east, and 5,400 feet at Triangulation Peak to the north. This watershed has the highest elevations and the highest amounts of precipitation in the North Santiam River Subbasin. Precipitation, 65-100" annually, most often comes in the form of snow creating heavy snowpack at the highest elevations.

Vicinity Map



Upper North Santiam Watershed Analysis
Detroit Ranger District

Scale 1:500,000
07/07/95

Map 111

Land Management Plan Allocations (see map 2):

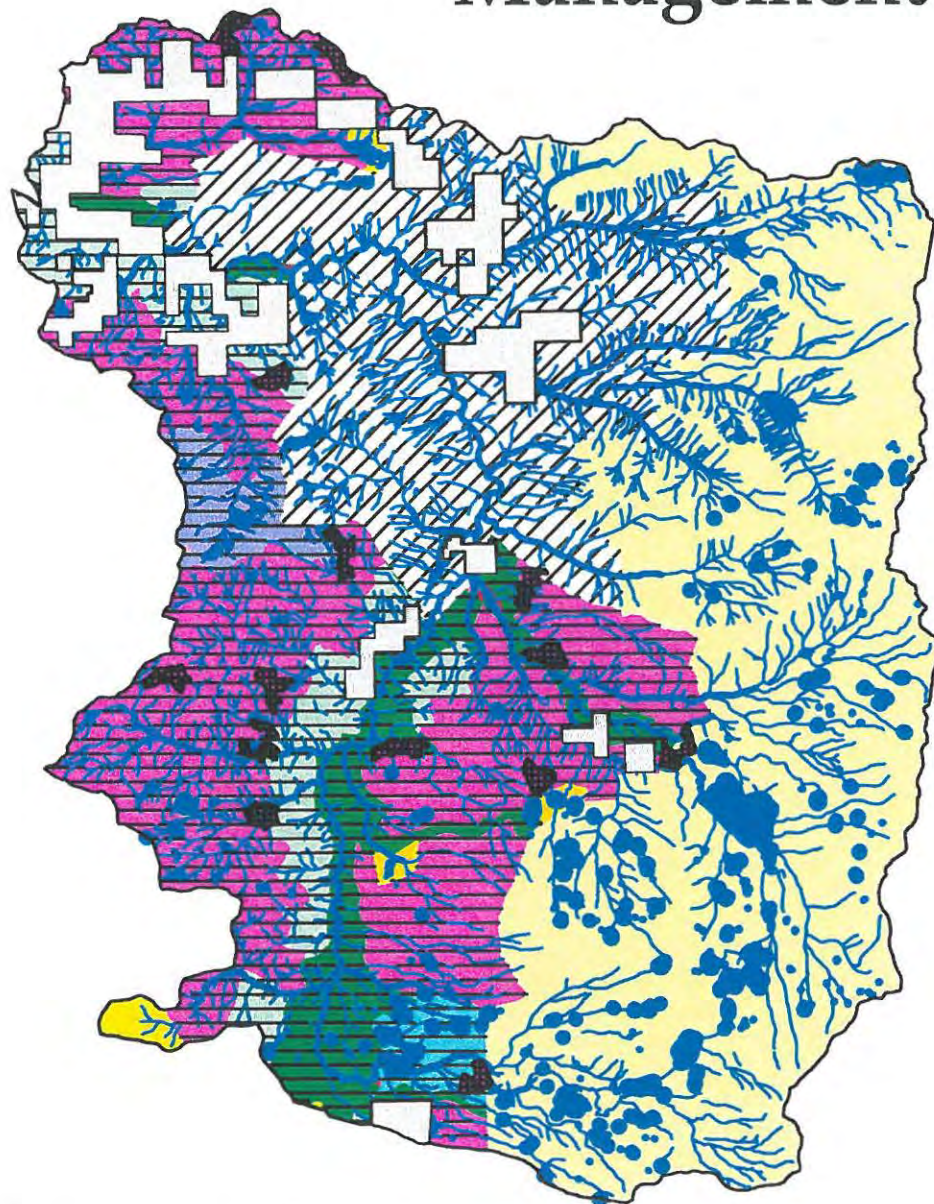
Allocations	Acres	% of Watershed
Wilderness	52,923	38%
Late Successional Reserve (LSR)	25,468	18%
Late Successional Reserves / Known Spotted Owl Activity Centers (LSRs)	1,462	1%
Remaining Land Management Plan - No Harvest	1,329	1%
Riparian Reserves in Matrix	15,103 *	11%
Matrix	32,168 *	24%
National Forest	128,453	---
Non-federal	9,467	7%
Total Acres	137,920	100%

* Additional streams will be identified during field reconnaissance

Management allocations with programmed harvest: 32,168 24%
 Visual / Middleground modification, General Forest, Remaining visual allocations, Recreation allocations in Matrix

Management allocations with no programmed harvest: 105,752 76%
 Late Successional Reserves, Riparian Reserves, Private, Wilderness, Other Land Management Plan no harvest

Management Allocations



Legend

-  Project Boundary
-  Spotted Owl Activity Centers
-  Matrix
-  Developed Recreation
-  General Forest
-  Late Successional Reserve
-  No Harvest
-  Other Scenic
-  Private
-  Riparian Reserve
-  Scenic Modification Middleground
-  Semiprimitive Motorized
-  Semiprimitive Nonmotorized
-  Special Uses/Administrative Sites
-  Wilderness



Upper North Santiam Watershed Analysis
Detroit Ranger District

Scale 1:200000
July 1995

Map #2

Land Management Plan Allocations (cont.):

Management Allocation	% of the Upper North Santiam Watershed
Acres in a Tier 2 Key Watershed	88%
Acres within Riparian Reserves	32%*
Acres within LSR	18%

* Additional streams will be identified during field reconnaissance.

Other Management Considerations:

- Upper North Santiam Watershed is 28% of North Santiam Subbasin.
- Two roadless areas, Mt. Jefferson North and South are located within this watershed.
- The North Santiam River has been determined to be eligible for inclusion into the Wild and Scenic Rivers system.

Non Federal Lands: Discussions on vegetation and wildlife are limited to National Forest Lands. Discussions on the social and physical environment include Non Federal lands.

HUMAN USE AND SOCIAL EXPECTATIONS

Past Human Uses:

The Upper North Santiam watershed has been the setting for human activities for thousands of years. The material remnants of use left behind are primarily in the form of lithic scatter sites, rock cairns, stone quarries, peeled cedar trees (for basket making, clothes), trails, land claims, homesteads, early Forest Service administrative and communications networks, guard stations, fire lookouts, railroad grades, early logging, and wagon roads.

Socio-economic:

The North Santiam Canyon community is the portion of the North Santiam River Subbasin from the headwaters to Mehama. The communities within the Canyon have come to rely on forest products from National Forest lands for their livelihood. Thus, they have been affected by declining timber supplies. Unemployment rates are higher and per capita income is lower than the county averages (see table 1). The mills within the Canyon are locally owned and have had to look outside the Canyon for logs. Idanha is almost completely dependent on wood products for its economy.

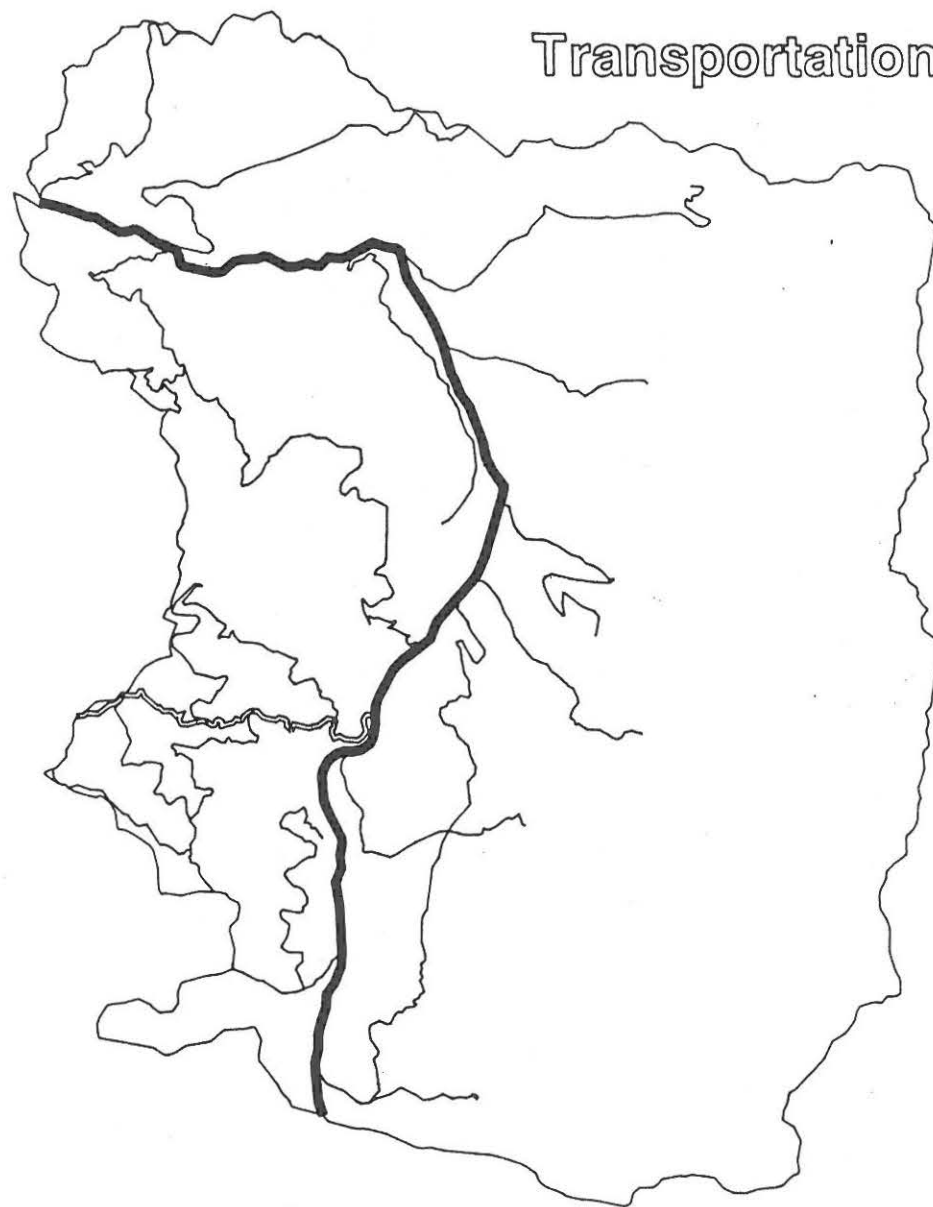
Table 1 - Unemployment Rates and Per Capita Income:

Community	Population	Unemployment	Per Capita Income	% Below Poverty Line
Idanha	213	8.0%	\$ 9,917	15.20%
Detroit	322	16.8%	\$11,130	11.90%
Gates	500	14.6%	\$ 9,400	23.20%
Mill City	1,572	10.4%	\$ 9,697	16.50%
Lyons	935	8.6%	\$ 9,625	12.20%
Marion County Total	228,483	6.3%	\$12,228	13.20%
Linn County Total	91,227	7.8%	\$11,443	13.50%




Recently, President Clinton's Economic Adjustment Initiative made available money and hope for economic diversification to these towns, who are among the communities listed as "economically depressed due to shortened timber supplies." Federal, State, and County regulations and limited infrastructures have increased the cost of attracting new businesses to the area, and have prevented the expansion of existing businesses. This means that, for the small towns to continue their existence, they will continue to depend on a timber supply to feed the existing dominant industry.

Tourism and recreation use are becoming an important part of the overall local economy. The Upper North Santiam watershed receives intensive recreational use due to its proximity to major population centers. Currently, the area attracts at least 200,000 visitors annually. Eighty-five percent of the visitors are from the mid-Willamette Valley and Portland Metropolitan area.

Transportation



Legend

-  Highway 22
-  Arterial Roads
-  Collector Roads



Upper North Santiam Watershed Analysis
Detroit Ranger District

Scale 1:200,000
07/26/95

#3

Recreation:

The Upper North Santiam provides diverse, high quality, all-season recreation opportunities, ranging from developed and dispersed activities along the North Santiam River Highway to pristine back country experiences within the Mt. Jefferson Wilderness. The unique long and narrow configuration of the Mt. Jefferson Wilderness provides easy access to numerous attractive destinations.

Developed recreation sites within the watershed include four campgrounds (one with horse facilities) that are located along the North Santiam River. Mt. View Park, a privately owned campground and RV park, is located on the North Santiam River in the city of Idanha. There are also various special use permits that provide seasonal recreational occupancy in the area. These include Camp Pioneer Boy Scout Camp located at Pine Ridge Lake, Marion Creek summer homes, and the Chemeketan Outdoor Club cabin near Whitewater Creek.

Campsites within the Upper North Santiam (Inventoried Sites)

<u>Type of Site</u>	<u>Number of sites</u>
Dispersed Sites within the Mt. Jefferson Wilderness	865
Dispersed Sites outside the Mt. Jefferson Wilderness	214+
Developed Campground Sites	77
Mt. View Park (private campground)	27

All of the Forest Services developed campgrounds, organization sites, summer homes, and approximately 90% of the dispersed campsites lie within Riparian Reserves.

McCoy winter recreation area and portions of Maxwell and Big Springs Snow Parks lie within the watershed. These are the closest winter recreation areas to a large percentage of the Mid-Willamette Valley population.

Access:

Roads: To accommodate public use and resource management and protection, the current transportation system within this watershed consists of about 400 hundred miles of Forest Service system roads. A dominant road in this area is Road 11 at Straight Creek. Paved between Sweet Home Ranger District and Detroit Ranger District, Road 11 provides access to historic Quartzville mining area from the north. This road is designated a Back Country Byway by the Bureau of Land Management. The remaining system of collector and local roads provides access to federal, state and private land. Map 3 shows the main roads within the watershed.

Trails: Within the wilderness, visitors can access an abundance of subalpine lakes, meadows, volcanic cones and other topographic scenic features through 111 miles of trails, including the Pacific Crest Trail. Outside of the wilderness, 30 miles of hiking trails exist with a network that links Coffin Mountain, Bachelor Mountain, Bugaboo ridge and Bruno Meadows, and Independence Rock near Marion Forks. Numerous trails that enter the wilderness originate outside of the boundary.

BIOPHYSICAL CHARACTER

Physical Character:

The Upper North Santiam valley has an east/west orientation within the lower portion of the watershed and then shifts to a north /south orientation upstream of the confluence of Whitewater Creek.

The watershed is distinctive in that it falls within both the Western Cascade and High Cascades physiographic provinces. The dividing line between these two provinces generally follows along the main stem of the North Santiam River with the High Cascades to the east and the Western Cascades to the West. As the river turns sharply west at the Whitewater confluence, this line becomes much less distinct, and the High Cascades tends to lap over onto the Western Cascades.

This watershed has been further stratified by landform blocks with common geology and geomorphology to identify processes that affect biophysical conditions. Ten subwatersheds can be found in 6 landform blocks within this watershed (see maps 4 & 5 in back jacket). Four landform blocks fall within the Western Cascades and two landform blocks fall within the High Cascades (see table 2).

From a soil failure standpoint, most of the watershed is stable. The Mary and Straight landform blocks contain most of the localized areas of slope instability within the watershed. Most sediment input to the streams in the natural system is supplied by the more gradual activities of soil creep when vegetative cover is common, and ravel/slough or rill wash when vegetation is removed, primarily after catastrophic fire events. Pleistocene glaciation has been an active slope forming process.

Table 2 - Landform Blocks:

PHYSIOGRAPHIC PROVINCE	LANDFORM BLOCK	SUBWATERSHED	ACRES / % of Watershed	CHARACTERISTICS	INSTABILITY
Western Cascades	Mary	That portion of Idanha, south of the river	10,558 8%	Complex topography of older land flows and glacial deposits.	Moderate to High
	Straight	Those portions of Upper North Santiam, Twin Meadows, and Bugaboo, west of the river	22,637 16%	Stable gently sloping glacial uplands transitioning to steep V shaped stream channels in volcanics.	Moderate
	McCoy	That portion of Idanha, north of the river; Tunnel; Boulder	14,295 10%	Glacial bench and scarp topography.	Low
	Bruno Mtn	Those portions of Whitewater and Riverside, west of the river	2,558 2%	Steep, shallow soiled mountain sides.	Low to Moderate
High Cascades	Jeff	Riverside and Whitewater, east of the river; Pamelaia, Marion	63,739 46%	Series of coalescing U shaped glaciated valleys. Broad valley bottoms.	Low
	Meadows	Upper North Santiam and Twin Meadows, east of the river	24,138 18%	Glaciated, gently sloping uplands.	Very Low

Biological Character: Common Biological Characteristics within this watershed include:

- A wide range and high diversity of habitats due to aspect, elevation, topography, and past management.
- Special habitats for plant and animal species, i.e., large meadows, high altitude lakes, subalpine vegetation, flood plains, dry non-forested habitats, avalanche paths, etc.
- The most habitats for high elevation dependent species in the North Santiam River Subbasin. i.e. the great gray owl, wolverine, whitebark pine, etc.
- The coldest plant associations in the North Santiam River Subbasin.
- A Western spruce budworm infestation within the mountain hemlock plant association zone, which has caused significant forest health problems.
- A high % of the area burned in the last 150 years. Fire risk has increased. Spruce budworm defoliation and east wind exposure are dominant factors increasing fire risk.

Fire is the dominant natural process affecting the development and maintenance of habitats within this watershed. Forest management activities and fire suppression have interrupted the natural fire cycle which affects vegetation composition and fuel loadings and consequently increased the risk of catastrophic fires.

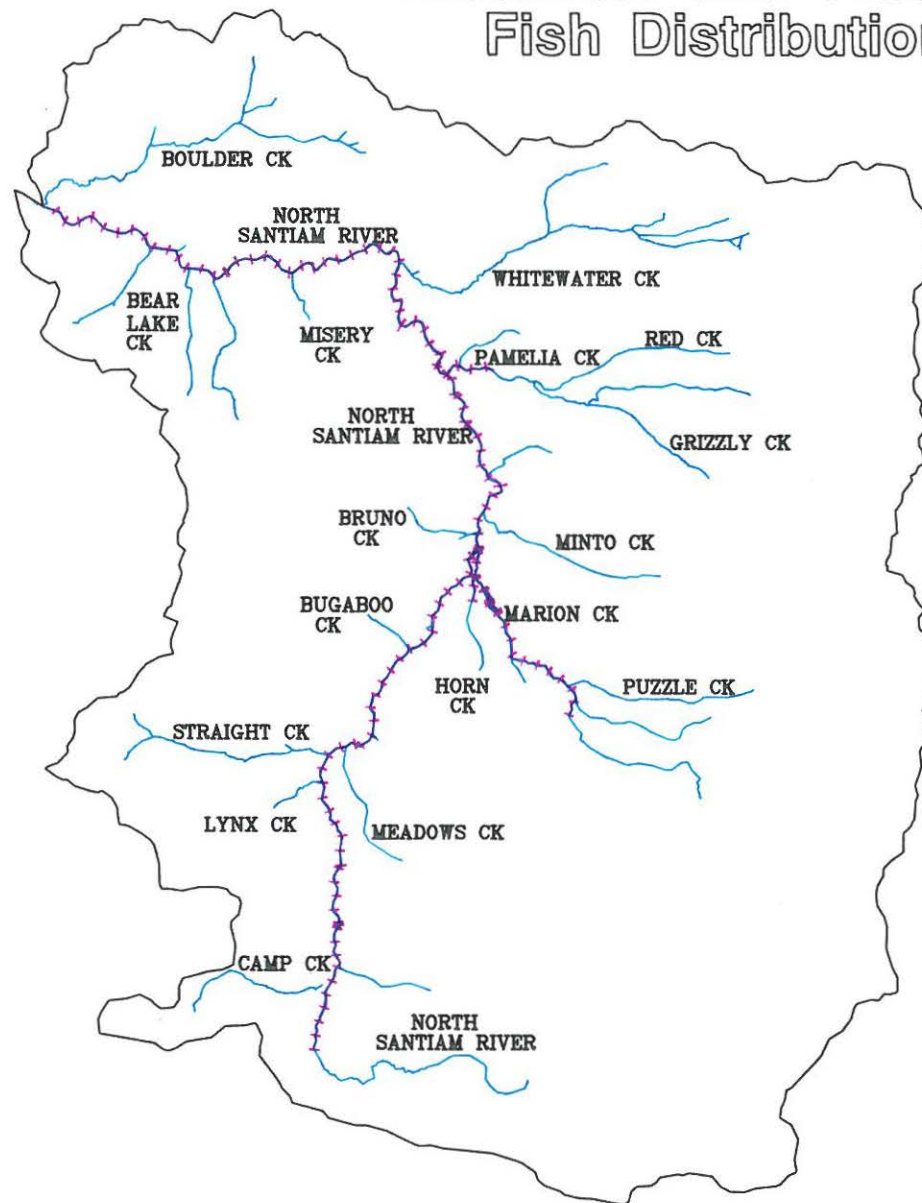
Aquatic Systems:

Aquatic Habitat: The Upper North Santiam is historical anadromous fish habitat (see map 6). Detroit and Big Cliff dams blocked these fisheries from the watershed and Oregon Department of Fish and Wildlife (ODFW) has plans to reintroduce those species in the future. There is a lack of large woody material and quality pool habitat within the main stem of the North Santiam River and Marion Creek.

There are 107 miles of known fish bearing streams in the Upper North Santiam watershed (see table 3). Existing gamefish populations include rainbow trout, cutthroat trout, brook trout, white fish, kokanee, and land locked spring chinook salmon, along with non-game fish such as sculpin and dace. Stocked fish make up the majority of anglers' catch within this watershed. ODFW stocks 33,500 catchable size rainbow trout in the Upper North Santiam River from Idanha to the headwaters each summer.


Many lakes and ponds are also found in this watershed. More than 70 of these lakes, most of which are in the wilderness, have been stocked with fish by ODFW to provide angling opportunities for the public. In 1995 ODFW is planning to stock about 50,000 fish in the lakes to maintain these populations.

Historical and Existing Fish Distribution



Legend

 Existing Resident
Fish Distribution

 Historical Anadromous
and Existing Resident
Fish Distribution



Upper North Santiam Watershed Analysis
Detroit Ranger District

Scale 1:200,000
07/26/95

Map #6

Table 3 - Riparian Reserves (see map 7):

Type of Riparian Reserve	Description	% of Riparian Reserves	Miles
Class I Streams	Anadromous fish bearing streams or domestic water source	6%	39
Class II Streams	Resident fish bearing streams	11%	68
Class III Streams	Non fish bearing perennial streams	14%	191
Class IV Streams	Non fish bearing intermittent streams	44%	607
Lakes		16%	
Ponds (less than 1/4 acre)		5%	
Marshes and Wetlands		4%	

There are a number of sensitive aquatic insect species that may be found in the North Santiam River. No surveys have been done but the species have been found in similar habitat types on the Forest.

The Upper North Santiam is the municipal watershed for the communities along the North Santiam River. Management within this area is closely monitored by all of the downstream communities. Beneficial uses found within the watershed include: Domestic water supplies, Fisheries, Recreation, Agricultural, Industrial, and Municipal. Domestic uses are associated with individual land owners. Municipal uses are associated with the City of Idanha and Marion Forks. Fisheries' uses are associated with anadromous and resident fisheries, and non game aquatic species. Recreation uses are associated with campgrounds and the presence of a highway within the North Santiam riparian reserve. Agricultural uses are associated with small farms and homesteads around Marion Fork and Idanha. Industrial use is associated with the Green Veneer mill located in Idanha along the North Santiam River.

Instream flow requirements would vary over the landscape due to topography, vegetation, and beneficial uses. Prioritization of the Western Cascade watersheds has not been completed by the State of Oregon. Minimum instream flows are therefore outside the scope of this analysis and are not addressed within this document.

Riparian Reserves



Legend

-  Lakes
-  Streams
-  Wetlands

Upper North Santiam Watershed Analysis
Detroit Ranger District

Scale 1:200000
07/06/95

Map #7

Threatened and Endangered Species (T&E) and Biodiversity:

Maintaining the wide range of habitats within this watershed is important for the protection of threatened, endangered and sensitive species. Three threatened and endangered species have habitats within this watershed. The northern spotted owl is the most prominent late successional T&E wildlife species. Bald eagles can be found at Marion lake, and there is habitat within the watershed for the peregrine falcon. Twenty-five wildlife Sensitive and Species of Concern have habitat within the watershed. Four sensitive plant species occur within the watershed.

Northern Spotted Owl: This watershed is located within the core of the northern spotted owl range for habitat. This watershed contains 64% of LSR RO214. There are 36 northern spotted owls with home range centers inside the watershed, of which 17 (47%) are also within the LSR. Dispersal habitat for northern spotted owls is currently below desired levels on 29% of the watershed overall and 26% of riparian reserves. Dispersal habitat quality between LSRO214 and LSR RO213 to the south is of primary concern in the Straight and Lynx Creek areas.

Vegetation:

Habitat characteristics vary by landform block and by plant association series. Table 4 shows the major plant association series in the Watershed and sample characteristics (see map 8 in back jacket):

Table 4 - Plant Association Series and Site Characteristics:

<u>Plant Association Series</u>	<u>% Watershed</u>	<u>Site Temperature</u>	<u>Elevation</u>	<u>Tree Growth</u>
Western hemlock	13%	warm	low	high
Pacific silver fir	47%			
Mountain hemlock	40%	cold	high	low

Mountain Hemlock Plant Association Series: The area of the watershed occupied by the mountain hemlock plant association series is most susceptible to natural fire. Cold temperatures and short growing seasons characterize the area. Plant diversity is generally low on most sites with only a few tree species. Beargrass, huckleberries, and rhododendron make up most of the understory vegetation. However, plant diversity is high in the numerous special habitats found within this zone. Due to large fires in the past, stands tend to cover large areas and are uniform in comparison to lower elevation stands.

Noxious Weeds: Noxious weeds have been a successful competitor along some roads and highly disturbed sites such as rock pits. For example, the Highway 22 corridor has been a conduit for the spread of spotted knapweed and most of the populations on the district are found there. Other noxious weeds in the watershed include Canadian thistle, bull thistle, Scotch broom, St. John's-wort, and tansy ragwort.

Terrestrial Wildlife:

A wide range of wildlife species coincide with the range of habitats within this watershed. It provides habitat for approximately 290 species. Few surveys have been conducted on most species, except for the Northern Spotted Owl and Roosevelt Elk.

In addition to the wide range of habitats present, the crest of the cascades is an area where a mix of species associated with habitats east of the crest often overlaps onto the western slope of the Cascades.

Habitat conditions for species such as cavity excavators are variable across the watershed. Snag quantities and large woody material (LWM) are below desired levels on 28% and 13% of the area respectively. These low levels occur primarily on pre-1990 harvested units.

Big game winter range, below 3800 feet, encompasses 16% of the watershed, primarily from Marion Forks, downstream to Idanha. All winter range areas are managed to meet high elk emphasis standards and guidelines per agreement with ODFW.

ISSUES AND KEY QUESTIONS

ISSUES: SOCIAL AND RECREATION (SR)

SR1 Sustainable Communities: The cities and unincorporated communities in the North Santiam canyon depend heavily on federal lands for their livelihoods. Economies are tied to the health of the ecosystems over time.

- Timber production provides the highest paying incomes.
- Special forest products provide an opportunity to diversify local economies.
- Maintaining a diverse set of recreational opportunities is beneficial to the local economy by enhancing tourism within the watershed.
- Elk, deer, and other game animals contribute to the social and economic demands of the community.
- Lack of available firewood is a concern for forest users.

Key Questions

SR1a Where are the treatment opportunities within the watershed that will contribute to sustainable communities? ** **Recommendations : pages 76, 87, map 25, Appendix 3: pages III-V**

What are the additional, marketable products that can help diversify the local economies that are not now being sold from the watershed? **Past, Reference, and Current Conditions: page 41**

SR2 Native American Tribes: Areas within this watershed may have been used traditionally by Native American tribes for religious and/or cultural purposes. There is a need to identify these areas that were used historically by Native American tribes and that still are an intricate part of their cultural and/or religious practices. This is to assure that forest management strategies are consistent with these uses.

Key Questions

SR2a. Where are the sites in the watershed that hold special significance to Native American tribes, how are they used, and how can we manage resources in those areas to be consistent with Native American values? **Past, Reference, and Current Conditions: page 49**

** Section of the document where the key question is discussed.

SR2b. What tribes use this watershed? What "usual and accustomed rights" exist within the watershed? Where are the "ceded" lands within the watershed? **Past, Reference, and Current Conditions: page 48**

SR2c. Where do current forest practices conflict with tribal objectives? What effect do Warm Springs reservation policies have on the local communities? **Past, Reference, and Current Conditions Condition: page 48**

SR3 Heritage Resource Sites: Heritage resource sites are an important source of information for past use in the area, and for current Native American uses. Many heritage resources sites have been impacted by human and natural processes. Very few adversely affected heritage resource sites have been mitigated to determine their eligibility to the National Register of Historic Places.

Key Questions

SR3a How have human uses, natural processes and management activities impacted heritage resources? **Past, Reference, and Current Conditions: page 49**

SR3b What are the historic and prehistoric human use patterns within the U.N.Santiam watershed? **Past, Reference, and Current Conditions: page 38**

SR4 Supply and Demand for Recreational Opportunities: There is a growing demand for a diverse set of recreation opportunities within the forest setting. The existing supply for some opportunities is inadequate to meet current and/or future demand. Increasing demand for diverse recreational opportunities within the Upper North Santiam watershed may contribute to additional conflicting resource uses in the future.

Key Questions

SR4a How can the watershed best provide diverse opportunities that reflect the current and future needs and demands of forest visitors? **Trends, Management Implications and Conclusions: pages 66-68, Recommendations: page 77**

SR4b What and where do conflicts exist between recreational use and other uses within the watershed? **Past, Reference, and Current Conditions: page 47**

SR5 Intensive Recreation Use: Intensive recreation use in localized areas within the Mt. Jefferson Wilderness, along the North Santiam River, and other popular riparian recreation areas has affected forest resources, visual quality, social encounters, and visitors' recreational experience. Some recreational uses result in conflicts with other forest resources, and between recreationists who participate in various legitimate uses of the forest.

Key Questions

SR5a What impacts do current levels of recreational use have on natural resources? Where are unacceptable impacts occurring? **Past, Reference, and Current Conditions: pages 43-47**

SR5b. How and where are current levels of recreation use impacting user experience, including scenic quality, social encounters, and user conflicts? **Past, Reference, and Current Conditions: pages 43-47**

ISSUES: ACCESS AND TRAVEL MANAGEMENT (AT)

AT1 Access and Travel Management: The transportation network has created conflicts between the needs of system users and requirements to protect the resources. Road maintenance budgets are not sufficient to maintain the road system. Thus, safety and access are affected. High road densities and conditions created by lower maintenance levels may further impact resources.

Key Questions

AT1a What and where are the access needs in the watershed? **Past, Reference, and Current Conditions: page 43, Appendix 3: page I**

AT1b What and where are resource impacts occurring with the current road system, and with the current maintenance level? **Key Processes: pages 26-27**

AT1c How and where will implementation of current direction, and road closures due to lack of maintenance affect human use patterns in the watershed? **Key Processes: pages 28-30**

AT2 Safety along State Highway 22: The Oregon Department of Transportation (ODOT) has numerous concerns about current traffic safety throughout the corridor. Along State Highway 22, many large deteriorating trees pose potential safety hazards to highway corridor users. Another traffic issue is safe access between the highway and developed campgrounds, dispersed recreation sites, and forest roads. One of these concerns is the potential for environmental damage due to hazardous material spills on Highway 22. The highway is an alternate trucking route to State Highway 26 for moving freight from the Portland area to the Bend area.

Key Questions

AT2a Where are the safety concerns along State Highway 22? **Past, Reference, and Current Conditions: page 42**

AT2b How can we work with ODOT to keep the highway safe? Under what conditions would widening the road conflict with current standards and guidelines? What mitigation measures can be taken? How can we combine ODOT objectives with current management direction? Where are ODOT projects along the highway? **Past, Reference, and Current Conditions: page 42**

ISSUES: FISHERIES AND HYDROLOGY (FH)

FH1 Fisheries: Detroit and Big Cliff Dams block migratory fish from historical spawning and rearing habitat in the upper part of the North Santiam river. A long range management objective for spring chinook salmon and winter steelhead trout is to reestablish naturally reproducing runs above Detroit Dam.

Key Questions

FH1a What are the fish species that have had migration patterns blocked or disrupted, due to the physical barrier of the dam, and to what extent have these migration patterns been altered? **Past, Reference, and Current Conditions: page 51**

FH1b What is the potential production of winter steelhead and spring chinook in the drainage? **Past, Reference, and Current Conditions: page 52**

FH2 Fish Habitat: Fish habitat complexity and quality is low in many areas of the North Santiam River, and its tributaries, due to natural events and management activities. Degraded habitats in the North Santiam may result in less spawning and rearing success, when anadromous fish are returned to the upper drainage. Based on limited sampling, there are indications that water temperatures exceed State Water Quality Standards at times in the North Santiam River and in Boulder Creek.

Key Questions

FH2a How does the current condition of the aquatic habitat relate to future re-introductions of winter steelhead, and spring chinook salmon? Are the conditions within the expected historic range of variability? **Past, Reference, and Current Conditions: page 52, Trends, Management Implications and Conclusions: page 70**

FH2b What, where, and in what priority, do we need to do restoration, or enhancement, for anadromous or resident fish? What are the priorities by subwatershed? **Recommendations: pages 80-81**

FH2c Where are the year-round cold water source areas for the streams in the U.N.Santiam, and where can their contribution be identified as important to the maintenance of cool stream temperatures? **Past, Reference, and Current Conditions: page 50**

FH2d What is the condition of the riparian reserves in the watershed and the distribution of those conditions? **Past, Reference, and Current Conditions: page 52**

FH2e What and where do developments occur within riparian reserves within the watershed? **Characterization: page 2**

FH3 Domestic Water Supply: This watershed has been identified as a Tier 2 key watershed and is the water supply for several communities along the river, including Salem. Management activities are a concern to some residents of those communities.

Key Questions

FH3a What processes affect stream channel morphology and water quality at the watershed scale, where do they occur, and how do these processes respond to management within the U.N.Santiam? (Also fish habitat issue) **Key Processes: pages 32-37, Recommendations: pages 80 - 82, Hydrology and Geology Reports**

ISSUES: VEGETATION AND WILDLIFE (WH)

VW1 Historic Range of Variability: Forest management activities may be creating vegetative conditions which lie outside the historic range of variability. These activities may affect the abundance, seral stage, distribution of certain plant associations and communities, and associated wildlife habitats.

- **Plant Diversity:** The amount, distribution, and condition of native plant populations and communities, may be reduced below a sustainable level as a result of past, present and future management actions. Increasing distribution and population growth of introduced and noxious weeds could reach unacceptable levels.
- **Wildlife Habitat:** Management practices have also had a varied impact on wildlife species associated with the created forest conditions. Connectivity between habitats is limited in some areas, and dispersal and migration patterns may be impacted. Past harvest units and some natural fire regenerated stands contain lower than desired levels of snags and large woody material for a variety of dependent species. There is also a concern of our ability to meet standards and guidelines for Survey and Manage Species (C-3) wildlife and plant species.
- **Northern Spotted Owl:** Current landscape patterns may not be meeting NW Forest Plan standards and guidelines for northern spotted owl dispersal outside the LSR.
- **Big Game:** Past management practices have fragmented big game habitat, and road densities currently exceed desired levels creating poor habitat effectiveness in some big game (elk) emphasis areas. In other areas, reductions in timber management will limit the available forage as existing stands mature beyond the point of providing grasses and many shrubs.

Key Questions

VW1a How and where are current vegetation types and distribution different from historic conditions? What processes led to those historic conditions? What types and frequencies of disturbance factors led to the current conditions? (Also issue VW2) **Key Processes: pages 22-33, Past, Reference, and Current Conditions: pages 60-63**

VW1b What and where are the opportunities within the watershed to restore some of the historic range of conditions (i.e., restoration, timber sales, thinning, other commodity producing activities, fire)? **Recommendations: pages 83-87, Appendix 3: III-V**

Plant Diversity

VW1c What nonnative species are increasing and where are those populations? What factors have contributed to their spread? **Past, Reference, and Current Conditions: pages 58-59, Botany Report**

VW1d What types of special habitats (rock outcrops, seeps, bogs, talus etc.) occur in this watershed? What is their current condition and what do they contribute to area biodiversity? **Past, Reference, and Current Conditions: page 58, Botany Report**

Riparian / J-2, C-3 / TES Species

VW1e What are the effects of management activities within riparian reserves on riparian associated late successional species of concern? **Past, Reference, and Current Conditions: pages 53, 55, Trends, Management Implications, and Conclusions: pages 72-73, Wildlife Report**

VW1f What wildlife species are present, or have habitats within the watershed? What characterizes their habitats and can these habitats be identified in the watershed? **Past, Reference, and Current Conditions: pages 53-55, Wildlife Report**

VW1g What TES, Table C-3 (ROD) and Appendix J2 (FEIS) species occur in the watershed, and what is the condition of their habitat, and known populations? What are the recovery needs of federally listed threatened and endangered species in this watershed? **Past, Reference, and Current Conditions: pages 55-57, Wildlife and Botany Reports**

Wildlife Allocations

VW1h How, when, and where will the riparian reserves network established in the FSEIS meet standards and guidelines for management indicator species (Pileated Woodpecker, American Marten)? **Past, Reference, and Current Conditions: page 53, Trends, Management Implications, and Conclusions: page 74**

Northern Spotted Owl

VW1i How do existing and projected habitat conditions provide for spotted owl nesting within the LSR and dispersal outside the LSR? **Past, Reference, and Current Conditions: page 54, Trends, Management Implications, and Conclusions: page 72, Wildlife Report**

VW1j Where might activities occur within the watershed that are consistent with NW Forest Plan needs for commodity production yet minimize adverse impacts to owls in the short term? What known northern spotted owl habitats or home ranges on harvestable lands should be “taken” first and last by future habitat removal or altering activities? **Recommendations: pages 83-84**

Elk / Game Species

VW1k What is the condition of elk habitat relative to land management planning standards and guidelines for habitat effectiveness? **Past, Reference, and Current Conditions: page 64, Trends, Management Implications, and Conclusions: page 75**

VW1l Does the current elk emphasis network meet standards and guidelines of the NW Forest Plan? How and where does management within elk emphasis areas need to change to comply with the NW Forest Plan? **Trends, Management Implications, and Conclusions: page 75, Recommendations: page 83**

VW1m What habitat restoration opportunities exist for game species in the watershed? Where do they occur? **Recommendations: page 85**

VW1n How and where do current road densities affect wildlife populations, hunting and poaching? **Past, Reference, and Current Conditions: page 64**

VW2 Fire Suppression and Vegetation: The inception of forest fire protection measures has resulted in increased stocking levels of understory trees, increased fuel loadings, changes in species composition, and a decline in general forest health. This decline in forest health is especially evident in the recent western spruce budworm outbreaks covering several thousand acres in the eastern portion of the watershed, particularly within the Mt. Jefferson Wilderness. **Key Questions - See VW1a**

VW3 Late Successional Reserve Protection: The NW Forest Plan guidance for Late Successional Reserves is to minimize loss of late successional stands by catastrophic wildfire. Reduced road maintenance and fire suppression resources will affect the ability to suppress fires within the Late Successional Reserve, where timber access roads are closed or no longer maintained.

Key Questions

VW3a Where are the areas of highest fire risk within the LSR? What are the barriers to protecting these areas from fire? What activities can mitigate fire risk? **Past, Reference Conditions: page 63, Recommendations: page 85**

VW4 Development of Late Successional Stands within the LSR: The amount and distribution of late successional stands in the Late Successional Reserve may be insufficient to meet the goals of the NW Forest Plan.

- Locally heavy blowdown may be hampering reforestation and slowing recovery of late successional stands.
- Opportunities to accelerate the rate of late successional development by stocking level control exist in overstocked plantations within the LSR.

Key Questions

VW4a Where are the stands in the LSR that would respond to treatment for the acceleration of late-successional characteristics? **Recommendations: page 83, map 24, Appendix 3: page IV**

Reference to key questions will be designated by the code in the margin. For example the discussion on the above key question will have (**VW4a**) in the margin.

KEY PROCESSES

Fire, forest management activities, other human influences, insects and diseases, climate and fluvial processes were main factors creating current social and biophysical conditions. These strong and dynamic processes created the wide range of habitats within the watershed. Some of these processes still have a strong influence on those habitats and site conditions.

Fire

Prior to Forest Service management, fire was the primary key process working within this watershed. Fire patterns and fire frequency have affected aquatic habitat; soil productivity; vegetation patterns and species distribution; and the distribution and abundance of snag and log habitat within the watershed. The oldest stands of trees for which there is documented information are approximately 600 years old. Due to the fire history in the watershed, it is estimated that there were less than 1000 acres of stands of this age in the watershed prior to timber harvesting. Currently there are probably several hundred acres remaining, most of which are located in the Late Successional Reserve.

The vast majority of older stands found in the watershed date from the early 1600's when fires burned over most of the watershed. This is consistent with stand ages found throughout the Detroit Ranger District.

A significant amount of acreage burned between 1820 and 1850 especially along the North Santiam river and on slopes to the west of the River. Natural under burning appears to have been common along the river bottom indicated by remnant old growth in most of the existing stands. Fires were also common at higher elevations in the southeastern part of the watershed, but tended to be stand replacement fires.

The 1890's was the period of most extensive fire activity in the watershed since the 1600's. In 1901 mapping of the Central Cascades Forest Reserve indicated 72% of the watershed in a disturbed condition (see table 5).

Table 5 - % of Watershed in a Disturbed Condition - 1901 Map:

Stand Condition	Acres	% of the Watershed
Burned	31,000	24%
Without timber	47,000	36%
Less than two thousand board feet	16,000	12%
Total	94,000	72%

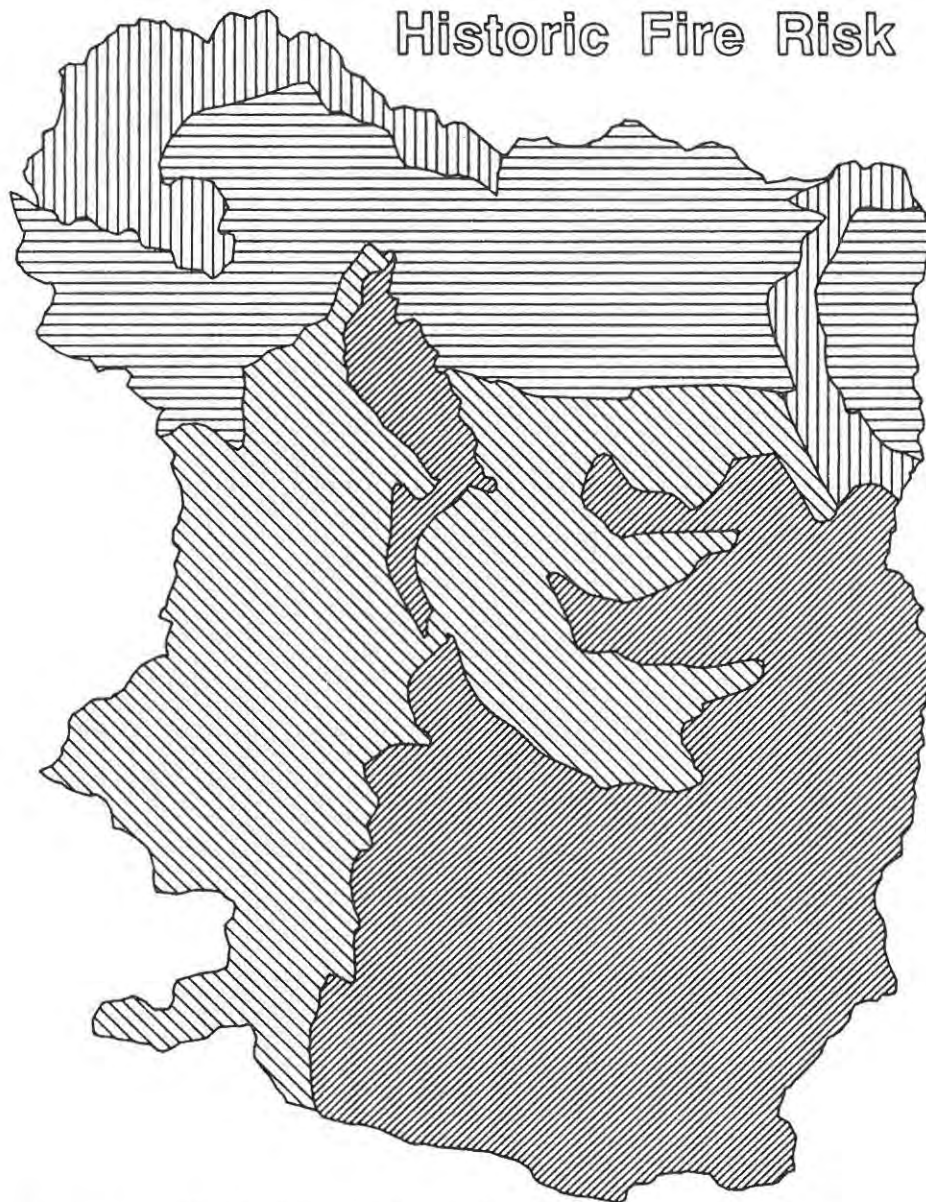
Using current size class mapping and known stand ages, it appears that about 62% of the watershed was in a recently burned or younger age class, < 50 years old, by 1895. Although it is difficult to reconstruct the method of mapping used in 1901, comparison with current size class mapping indicates a good correlation between both map locations and the scope of disturbance. Panoramic fire lookout photos taken during the 1930's clearly show evidence of extensive burning that would correspond to the 1890's period.

Fire Patterns: The most active area of the watershed, in terms of past fires, is east of the river and south of Pamela Creek, especially in the portion associated with the mountain hemlock plant association series. Exposure to east winds in the fall and mortality from Western spruce budworm defoliation, which is currently prominent in the area, are strongly suggested as factors that contribute to a high level of past disturbance in this part of the watershed. Approximately 77% of the mountain hemlock series is in a size class that is the result of burning over the past 100 years.





The areas of the watershed with the least evidence of recent fire activity are the wide glacial drainages of Whitewater, Pamela and Marion Creeks, the area north of Mt. Bruno to the river, and except for the steeper south slopes, the McCoy area. These are all west of Mt. Jefferson and historic burn patterns suggest that the mountain may help break up the east wind pattern that dominates the rest of the watershed adjacent to the Cascade crest. The wide, flat drainage bottoms of the creeks mentioned also act as a barrier to reduce the potential for large fires.

This is evident east of the river, where U shaped valleys created moister microclimates and fire was slow moving and cool burning. The exception is in the mountain hemlock zone where the fire regime is heavily influenced by east winds and a higher fire frequency (see map 9).

Historic Fire Risk



Legend

-  Low
-  Medium
-  Medium to High
-  High



Upper North Santiam Watershed Analysis
Detroit Ranger District

Scale 1:200000
07/26/95

Map #9

Causal Mechanisms and Triggers: Lightening has been the primary cause for most of the historic large fires within the watershed. Although humans may have accidentally or deliberately set fires in the past, there is no evidence that these fires were of the same scale as lightening caused fires.

Fire Risk Factors: Lightening or human ignitions, fueled by east winds, create stand replacement and understory fires. Ignitions within this area have a tendency to smolder until east winds fuel the flames. Fire suppression efforts have been very successful in interrupting the relationship between ignitions and east winds.

Fire risk within this watershed has increased with an understory ready to burn, with damage in the stand from spruce budworm, and with the presence of ladder fuels. Periodic low intensity fires kept most true firs out of the understory, and lessened the amount of fuel buildups. Uncontrolled fire at high fuel loadings and low fuel moisture will increase fire severity significantly.

All drainages bordering the crest on the Deschutes side have fingers of budworm defoliation extending to the crest. Combine these conditions with an east wind and the fire risk increases substantially. The LSR within this watershed falls within the high fire risk area from this source.

The three most important biotic influences operating within the Upper North Santiam are human, insects and diseases.

Human:

Fire suppression: Fire suppression activities have been very successful in controlling most fires since 1900. Organized fire suppression probably began in the 1890's with the construction of the Independence Prairie Guard Station. Public policy to minimize resource loss and threats to public safety led to increasing abilities to keep fires small. Increasing technology, personnel, road access, timber harvest and subsequent fuel treatment has combined to reduce acres burned and have lessened the severity of fires.

Evidence seems to indicate that fire suppression, predominately in the mountain hemlock zone, has affected the development of stands and existing openings. One of the results of these fire suppression efforts is an increase in budworm activity. The longer a stand goes without fire, more of the understory becomes true fir, and this is the western spruce budworm's preferred food. Within a multi canopy forest, budworm drops into the true fir understory.

Timber Harvest Practices: The first significant timber harvest began in the 1940's on both public and private land (see table 6). In general, logging practices from the 1940's into the 1960's consisted of logging the lower elevation, easier ground first. Ground skidding with tractors was used in flat portions of the Meadows and Jeff landform blocks, and contributed to soil compaction in these areas (See Soil Productivity discussion in the next chapter).

Table 6 - Timber Harvest by Decade:

Years	Acres
1940 - 1949	700
1950 - 1959	2,500
1960 - 1969	4,300
1970 - 1979	8,000
1980 - 1989	14,100
1990 - 1993	1,600

From the earliest timber management activities to 1970, snags were cut and left on the ground, decreasing the snag component on harvested units, yet retaining the large down woody material.

During the 1960's broadcast burning was done in the fall and frequently was associated with dry conditions which resulted in hot burns and excessive duff consumption. Between 1970 and 1990, most snags were cut and little large woody material was left on the ground. As a result of these burns and the utilization of unmerchantable material, many cut over stands currently have low levels of snags, down woody material and duff.

Historically, the predominant species planted at the lower elevations was Douglas-fir. Noble fir was a preferred planting above 3000 feet. The 1980's saw the addition of most of the indigenous conifer species to the list of species planted. The 1990's have added increased hardwood planting in some local areas, especially in root rot pockets.

Timber stand improvement began in the 1950's with pruning and precommercial thinning. Early precommercial thinning tended to leave stocking levels higher than are currently regarded as optimum for acceptable growth. Thus, from a timber management perspective, there is overstocking in some managed stands.

The 1990's brought changes in timber harvest practices including standards for site preparation, down wood and snags.

Forest Management Changes: Beginning in the 1960's, along with increasing levels of timber harvest came a succession of laws addressing air, water, and the terrestrial environment. The listing of the northern spotted owl and the shift to ecosystem management are the most recent changes to forest management policy. With forest management policy changes, came a drastic reduction in timber harvest on federal land, and changes in the management of aquatic systems, riparian, and late successional habitats.

Recreation: The Upper North Santiam receives intensive recreational use due to its proximity to major population centers and the array of recreation opportunities. Future recreation use will be affected by changes in various socioeconomic indicators, particularly population growth. With projections of increased population growth for the mid-Willamette Valley and Portland Metropolitan areas, increased recreation use within the Upper North Santiam watershed can be expected for a wide range of recreation activities.

Roads (AT1b)(FH 3a):

- Provided access to most of the watershed, including sensitive areas.
- Channelized some streams, along with the North Santiam river.
- Displaced native vegetation, created conditions for noxious weeds, and acted as a corridor for the transport of seeds.
- Created openings in vegetation, which in some cases leads to blowdown.
- Fragmented habitats, sometimes created barriers to movement, increased wildlife poaching, and reduced big game habitat effectiveness.
- Created edge habitat and travel ways for many species. They also make management and mitigation more accessible.
- Modified natural hillslope drainage networks by diversion of stream flows and interception of surface and subsurface flow.
- Increased the drainage network which influences the timing and magnitude of peak flows. This increase and its influence on peak flows has not been identified as a problem in this watershed.

- Opened up large areas to fire prevention and suppression activities that can reduce habitat loss from catastrophic fire events.

Sediment Production: Road related landsliding and surface erosion can deliver sediments to streams, both chronically and catastrophically during large storm events. Most of the roads in this watershed are built on stable benches and flats and do not have a significant effect on stream sedimentation. There are 3 subdrainages where roads are built on or near unstable land types where sediment is being produced. The roads in these areas can contribute to sediment production but most likely increase potentials.

Mary Landform Block: There is a concentration of unstable landforms in a central band across the middle of the subwatershed. The areas begin near Cabin Creek and are located across to Bruno Lakes and below Bruno Mt. Rd. 2234 from Rainbow Creek to Corset Creek. The North Santiam River is directly affected just above the Bruno Mountain bridge.

Straight Landform Block: In the southern end of this subwatershed, along Parkett and Buck Creeks, Rd. 1168 goes through some unstable landforms.

Straight Creek, in the northwest corner of the subwatershed, has a series of sediment producing areas along its course. Rd. 1164 goes through several of these before it crosses the creek and enters more stable ground.

There are other local roads that could be contributing to sedimentation on an intermittent basis. The most chronic sites had restoration done with the 1994 Jobs-in-the-Woods program. Additional inventory is needed to determine additional restoration needs.

Unsurfaced roads, especially those open to use during wet weather, result in sedimentation from surface erosion. This watershed has approximately 50 miles of native surface and/or improved surface roads. (Improved surface roads have pit run or low standard aggregate over a portion or all of the road.)

Corrugated metal pipe has been the preferred design choice for drainage on the majority of roads constructed. Only in the most recent years have alternative drainage structures been used to reduce maintenance needs. Many of these metal pipes installed over the past 40 years are nearing or exceeding their design life. As pipe failures occur, sediments to streams will increase.

(AT1c) Changes in Access:

Economics: Declining maintenance dollars are resulting in reduced access for all users in many areas of the watershed. Roads are becoming less accessible due to the lack of surface, drainage and roadside maintenance. At present roads are closing through cut or fillslope failures, stream crossing failure and brush encroachment. Erosion rates and potentials for road prism failures may or may not increase as ditches and drainage structures become inoperable. They could decrease as vegetation stabilizes ditch lines, roadcuts and fills.

These closures through neglect do not provide protection against resource damage or protection of the large capital investment made when these roads were constructed. The subwatersheds of Idanha, Bugaboo and the western portion of Twin Meadows contain more ground identified as actively unstable or potentially unstable. As a result, roads will close themselves in those areas quicker than in other more stable subwatersheds. With time closures through neglect will spread to all areas of the watershed.

Forest Plan as amended by the Record Of Decision (April 1994):

- **Tier 2 Key Watersheds:** The direction for a reduction in the miles of system and nonsystem roads points to the need to implement the forest wide Access and Travel management policy. Timber harvest activities requiring construction of roads could be curtailed if road decommissioning is not pursued.
- **Late-Successional Reserves:** With the exclusion of most timber harvest activities within this allocation, it may be hard to rationalize maintaining a large road system that was built to access land for timber harvest.

Limiting access will make enhancement and restoration projects more difficult and expensive to implement.

Risk to Late-Successional habitat from catastrophic fire events will increase as access to large blocks of land is decreased.

- **Riparian Reserves:** Current standards in road design and construction practices and existing Road Management systems and programs go a long way in meeting the Aquatic Conservation Strategy objectives.

Changes in Access:

Inventory and risk analysis to riparian conditions in a 100 year storm event have not been done. Analysis processes have been established but shortages of personnel available to do the work has delayed its completion. Probability that upgrades of stream crossings to accommodate the 100 year flood would occur are slim due to limited dollars and the high cost of such construction. Available restoration dollars might be better spent on higher return projects such as stream restoration and road decommissioning and storage.

Roads will be decommissioned and obliterated as the localized sites are identified and analyzed. Preliminary knowledge of the area does not indicate a substantial need, particularly for obliteration.

Private Land: Access to private land may become more difficult as local roads that have provided access in the past become closed due to lack of maintenance. There is a need for negotiated cooperative agreements to help meet the needs and management objectives of both the Forest Service and the private land owners.

Recreation: Declining access has many implications for recreation.

- Displaces established users to other areas that remain accessible. The more users that are displaced, the more significant the impacts to areas outside the road closures.
- Provides less access to people with limited mobility.
- Can increase semi-primitive opportunities
- Roads to trails opportunities may arise (ATV or ORV opportunities, equestrian, mountain biking trails)
- Make access to popular areas within the wilderness more difficult, which may have a positive effect on wilderness resource, less use as a result of a longer hike.
- Current supply of roaded opportunities exceeds projected use levels.

Fire detection and suppression: Detection from motor patrols will be decreased. Estimates indicate 60% of fires detected on the forest are reported by sources other than aircraft or lookouts. These sources include Forest Service and Co-op motor patrols, Forest Service employees and permittees, contractors' employees and the general public. The current level of open roads enables people to easily access a large percentage of the watershed outside of the wilderness.

Changes in Access:

Initial response times will be slower, allowing fire size to increase before suppression activities begin. Suppression activities will be delayed and/or limited by the need to open decommissioned roads or long hiking distances.

Availability of water for pump chances could be impacted.

With limited access there should be a decrease in the number of human caused fires behind closures. Human caused fire starts could increase in the remaining open areas due to increased user density.

Administrative: Commodities harvest; silvicultural and fuels treatments of managed stands; wildlife species and stream condition surveys; habitat enhancement, mitigation and restoration projects are just examples of management activities that will be impacted as the road system reduces in size. Maintenance of a road system that will support the type of harvest levels and management activities that the Forest Service is presently pursuing will be challenging from a financial standpoint. There will be an increase in cost in performing almost all aspects of resource management activities.

Insects and Diseases:

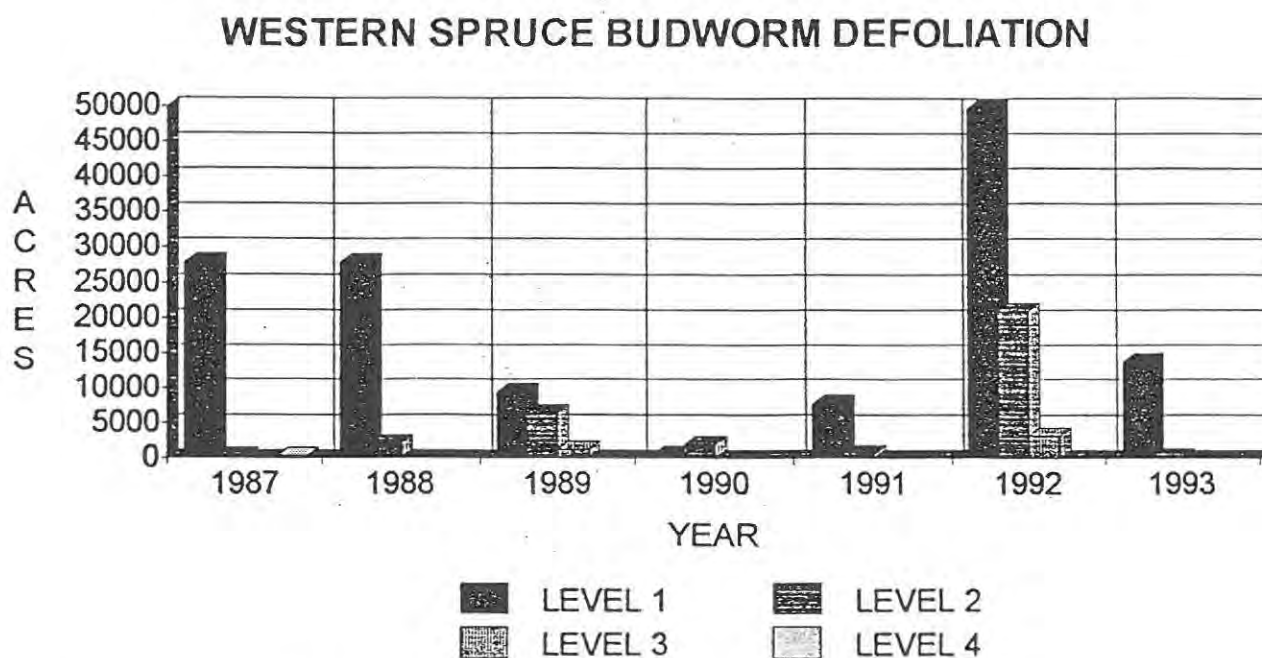
Historic levels of diseases are difficult to reconstruct. However, certain stand conditions are known to favor some of these agents. White pine blister rust was introduced into the region in the early 1900's. White pine was found at all elevations. In conjunction with mountain pine beetle attacks, 90% of the original white pine population may have been killed by this disease. By the 1980's rust resistant white pine planting stock was planted in this area.

Root rots, primarily *Phellinus weirii* and *Armillaria mellea*, are endemic to the watershed and would also have been in historic periods. There is evidence from research that suggests short rotation, single species, forest management may increase rates of infection. Root rot infection centers tend to be more difficult to spot in older stands due to other mortality factors. It may not appear to be as prevalent as in more uniform second growth stands. It is not clear whether the overall impact of infection is significantly greater than historic levels.

The Douglas-fir beetle and mountain pine beetle are the primary bark beetles within this watershed. The 1990 windstorm and several years of drought created favorable conditions for the Douglas-fir bark beetle, which generally occurs at low levels. Populations increased in downed trees and spread to standing trees which were weakened by several years of drought. Mountain pine beetle is most active in stands with older white pine and sugar pine, especially those that are experiencing high levels of competition or have received some mechanical damage.

Western Spruce budworm has been a significant defoliating insect affecting most of the mountain hemlock plant association series adjacent to the Cascade crest. This plant association includes the most susceptible species - Pacific silver fir, mountain hemlock, Douglas-fir, and Engelmann spruce. Historic evidence of defoliation in the watershed was only available back to 1947. Previous outbreaks were probably common given the favorable habitat and weather conditions. The most recent outbreak began in 1987 and continued through 1993 (see chart 1).

Chart 1- Spruce Budworm Outbreak:



LEVEL 1 - Current year's defoliation visible from air.

LEVEL 2 - Current year's defoliation with some bare tops visible.

LEVEL 3 - Current year's defoliation visible with a lot of bare tops some green foliage.

LEVEL 4 - Current year's defoliation with bare crowns, no visible green foliage.

Climatic and Physiographic Processes:

Physiographic and Climatic Processes have operated over the millennia to create the present landscapes. The watershed contains both the High Cascades and Western Cascades physiographic provinces. Landscapes in each were formed as the result of a combination of volcanic and glacial activity. These basic features were modified by stream erosion and slope instability to create the complexity that is apparent today.

High Cascades: The High Cascades contain the younger volcanic peaks of the Cascade Range as well as extensive fluvio-glacial and till deposits. Almost entirely Pliocene and Pleistocene in age (10,000 to 10 million years), the exposed basalt and andesite formations are younger than most of those in the Western Cascades. In some places the younger lava flows of the High Cascades may have flowed onto the Western Cascade materials.

The drainages of the High Cascades are predominately U-shaped glaciated valleys with flat valley bottoms and steep rocky valley walls that abruptly transition to rolling uplands at the higher elevations. Soils are generally glacial in origin, stable, gently to moderately sloping (for the most part), and young in age (less than 10,000 years).

Broad valley bottoms have unique and complex stream channels. Multi-channel streams dominated and shaped these valleys. Resulting low gradients depended upon large woody material to sustain and control stream energy. The resulting streams were high in diversity. Utilization of the flood plain was extensive, and channels would adapt and create unique energy signatures across the landscape. In the upland high altitude wetlands, lakes and potholes provide additional riparian diversity not associated with streams.

Western Cascades: The Western Cascades is comprised primarily of tuffs and breccias and range from Oligocene to early Miocene in age (25 to 40 million years). Extensive erosion, from glaciation, earth failures, and stream down cutting has occurred throughout the last several hundred thousand years to form the highly dissected valleys now present. The drainages that form this portion of the watershed are typical, low to moderate elevation, dendritic, stream systems.

Geomorphically a highly diverse region, landforms range from highly glaciated upland benches and head walls at the higher elevations to large scale, stabilized slump/earthflow complexes, to small localized areas of actively unstable ground, to highly dissected V-shaped valleys with steep side slopes and shallow rocky soils.

Many stream channels have also been altered by both glacial and earthflow activity. These areas often contain a complex drainage pattern that parallels the earthflows. Small wetland areas are well distributed in this Province. Many were created either by glacial or slump action. Bruno Meadows is an example of a larger wet meadow complex found within the Western Cascade portion of this watershed.

(FH3a) Processes Affecting Stream Channel Morphology:

Four key processes were the most influential in regards to the water dependent resources. These processes are fire, flood, earthflows, and management removal of large woody material from streams and riparian zones. During the discussion of these it is apparent that they are not totally separate but rather somewhat dependent upon each other. The following discussions are not intended to give all the possible interactions, but those most observable from office review and field investigation. Certain characteristics are found in all of the Subwatersheds. These characteristics are discussed first to provide an overview.

Fire: Those areas with a high concentration of earthflows created hillslope failures and sediment rich stream systems. These sediment rich systems would, depending upon the dominant weather patterns of the period, either widen the valley floor creating additional upslope instability or incise their valley floors creating channel bank instability. Vegetation would then invade the valley floors, upslopes, or channel bank areas and through time help stabilize the areas. Those areas not stabilized would provide diversity of plant species within the riparian area.

The removal of vegetation through fire can cause a shift in the hydrograph. Under this shift, water levels within streams will be quicker to peak and quicker to recede. Streams can have higher peak flows than typically generated under vegetated conditions. The stream channel can experience higher energy flows resulting from this shift. This increase in energy affects the channel conditions and habitat characteristics. Loss of vegetation in the uplands creates an opportunity for rain on snow events to impact channel conditions. The increase in the accumulation of snow, due to the lack of vegetation, provides a greater risk to increase peak flows being generated during warm rains.

Most of the channels found within the Upper North Santiam are fairly resistant to peak flow events. Exceptions do occur within in the unconsolidated glacial till areas found within Meadows, Jeff, and McCoy landform blocks. Valleys have been, and currently are being formed by larger magnitude events. A relatively high recurrence of peak flow events occur within the Western Cascades portion of the watershed. This is due to the rain on snow events that periodically occur in the area.

West of the river, in incised valleys, fires burned hotter, leaving little or no wood in class III and IV streams. Fire under burns occurred along class I and II streams.

Along Class I and II Streams: With each natural fire interval, large woody material became available for the riparian areas. Historic photos show that a mosaic would be created upon the landscape in relation to vegetation and stand size. Large woody material availability appeared to be abundant due to the fires lower intensity associated with the riparian areas.

This large wood was important to the stream systems for energy dissipation and sediment storage. The energy dissipation created abundant pool habitats within the stream system and numerous back water areas. Old side channels are still visible within certain valley floor segments within the watershed. As a result of the reduction of energy, the transport ability of water would be reduced and sediment and organic debris would be retained within the stream system.

Areas With High Historic Fire Frequencies: Areas within the Jeff and Meadows landform blocks contain a fire history that appears to be east wind dominated. These areas were predominantly mountain hemlock plant associations. "Large" wood was seldom created within these stands. The evidence of wood within the streams would have been present for only a short time. A correlation could be drawn to the fact that 100 years ago fire suppression started within the area, and the riparian areas have been able to retain their wood since then. On glacial till, moraine material, channels respond differently to the presence of wood than described in the previous paragraph. Pre- 1900's streams would have been cleaned of their large woody debris through fire in those areas with frequent fire intervals.

Management: Timber harvest also had an effect on aquatic systems. One of the management activities associated with harvesting is the development of a complex road system.

Roads may be important in regards to the extension of the drainage network and the potential change of the timing of peak flows. Interception of existing groundwater could also be affected through this road system. Existing channel conditions have developed with these mechanisms in place.

Roads within the watershed have affected the timing and transport of sediment within all landform blocks. Prior to 1985 roads constructed within these areas exhibit sidecast fills and poor drainages. These fills are currently generating some sediment into the channel. This sediment has the potential to create episodic events that alter channel morphology and biota. Due to the lack of structure within the North Santiam system any release of material, as in a debris slide, will travel downstream a greater distance than historically. (see Geology Report).

Removal of woody material is another management effect that was common within this watershed. Logging slash and large wood was removed to allow free flow of the water through the channel. Removal of large wood created a stream system that mimicked a high frequency high intensity fire pattern. With the loss of wood and the increased sediment off the roads the stream channels developed into very efficient sediment transporting mechanisms.

Flow Regimes: The location and weather patterns through the North Santiam Canyon dramatically affect portions of the watershed and its associated peak flows. Rain on snow events are a dominant process that creates extreme peak flows within the McCoy, Mary, and Straight landform blocks. As cool moist air passes to the east, Boulder, Bachelor, Coffin, and Fisher Point mountains slow this air mass to allow precipitation to occur.

The effect on the stream channels has been discussed under the fire and management scenarios under fire. It is anticipated that peak flows in this area were historically high in stage and frequency. Drainage densities reflect the historic abundance of runoff within the area (see table 7). The top ten floods on record, within the Willamette system can be found in table 8.

It is apparent during field investigations that flows of smaller magnitude, than those listed in table 8, shape and change the channels yearly. The amounts of disturbance the flows have within the watershed depend on the amount of large wood and the type of management within the area. Current channel conditions allow for a variation of flows without channel damage.

Table 7 - Stream Densities by Subwatersheds:

<u>Subwatersheds</u>	<u>Drainage Density</u> (miles of stream per square mile)
78-6 Idanha	4.2
78-7 Whitewater	4.6
78-8 Tunnel	4.8
78-9 Boulder	4.4
79-1 Riverside	4.6
79-2 Bugaboo	5.3
79-3 Twin Meadows	4.5
79-4 Upper North Santiam/Big Meadows	3.4
79-5 Marion	3.3
79-6 Pamela	4.9

Table 8 - Willamette System Floods:

Chronology	Years Before Present	Interval (years since the previous flood)	Ranking by Magnitude
1964	31	44	2
1920	75	19	9
1901	94	11	10
1890	105	9	3
1881	114	20	5
1861	134	12	1
1849	146	5	6
1844	151	1	7
1843	152	30	8
1813	182		4

Note: These are the ten greatest flows on record. Other flows have occurred through recorded time have shaped valley floors.

Earthflows: Under the Soils and Geology Report a complete discussion of the complexity and distribution of earthflow will occur. Discussion here will concentrate on the effect of earthflows on the stream system.

When an earthflow occurs, the channel would respond in several ways. If the flow contained sufficient large woody material, the distribution of the flow downstream would be minimal. The large woody material would slow the migration of the flow downstream due to its increased roughness. Terraces would be established upstream of the accumulation of the wood and the channels would either occupy intergravel space or meander on the terraces. Energy increases within the channel would occur as a result of the change in gradient at the toe of the flow. These increased energies removed finer materials and created high gradient channels, or cascade. If the material was alluvial in nature, as opposed to colluvial, intergravel water flows developed and water at low flow periods would run subsurface.

Portions of and certain earthflows scoured channels to bedrock depending on their speed and viscosity. These bedrock reaches for a short time would contain over steepened upper channel banks. Woody material would be recruited resulting from bank failures, and colluvium would then be collected. This process would rebuild the diversity within the channel.

Earthflows also created smaller channels along their margins or on their flow faces. Wetland areas would be created as sag ponds fill slump depressions or as a result of the earth flows that block existing streams.

Within the North Santiam these earthflows are the principle sediment producers within the Mary and Straight landform blocks. The sediment being produced is more episodic in nature due to the relative stable condition of the earthflows. (See Geology Report)

The 1964 Flood and Following Management: Much of the existing condition of aquatic habitat and riparian zones, especially in the larger streams, can be attributed to the building of Highway 22 in 1937, the 1964 flood and the management activities that have taken place since the flood. The flood tore through the streams, scoured the channels and washed much of the existing structure out of the system. Two hundred thirty acres of Detroit Lake were covered with debris. Some of the woody material that wasn't washed out ended up on flood plains and in log jams in the channels.

Stream clean out and salvage operations within riparian zones were the last major processes to create current aquatic conditions. Salvage operations removed wood from riparian zones and streams to reduce impact of wood during flood events. Portions of the North Santiam River, and Marion Creek, downstream from the confluence with Puzzle Creek, have been channelized. This separates the main channel from numerous side channels in the active flood plain. This also shortened the channel, increased the stream gradient and caused some channel down cutting. In the mid 1980's restoration activities began to reconnect Marion Creek with its historic flood plain. After 1990, restoration activities began to restore large wood and structure to Marion Creek and the upper North Santiam River.

PAST, REFERENCE AND CURRENT CONDITIONS

HUMAN USE AND SOCIAL EXPECTATIONS

Human Use and Development Patterns:

(SR3b) Humans have occupied the watershed for at least 7,000 years. The patterns of prehistoric and historic use within the Upper North Santiam watershed vary from north to south and from east to west. In the northern and most of the western portions of the watershed ridge lines received heavy prehistoric and historic use. In the eastern and southern portions of the watershed, evidence for prehistoric and historic activities is mainly confined to areas associated with well-watered zones, such as live stream courses, meadows, and lakes.

Native American: The site distribution patterns within the watershed suggest the prehistoric and protohistoric people were traveling along the North Santiam River corridor, Minto Pass Trail (east/west passage), Pamela Trail (east/west passage), and triangulation Peak trail for hunting, gathering of resources and trade. The Warm Springs people used these trails to get to Willamette Falls, a traditional fishing area. Additional information regarding use of the general area can be inferred from the oral history of the Warm Springs confederation as told by the elder women. They relate stories of their grandparents utilizing and maintaining the huckleberry grounds found within the area. They also spoke of their grandparents passing through the general area from the Cabot Creek drainage on the east side of the Cascades mountain range on route to the North Santiam River along what is now know as Minto Pass trail. This route was originally used by the Cayuse and Molalla Indians as an east/west passage.

Administrative: The early Forest Service administrative and communication networks, including lookout stations, guard stations and trail shelters were maintained by forest service personnel through an extensive trail network (often using preexisting aboriginal trails). These first trails were built for administrative access, primarily fire control. Independence Prairie is the oldest standing Ranger Station on the Willamette National Forest. This station was built sometime between 1906 and 1911 and abandoned in the 1930's after the highway was constructed up to Santiam Junction.

Grazing: Grazing of sheep was common place in the Wilderness from the early 1900's to the late 1930's except at Minto Mountain which provided grazing for cattle until 1964.

Homesteading: Independence Prairie was one of the first homesteads settled in this watershed. The cabin was constructed in the 1890's. The original homestead at Marion Creek was settled in 1915 by William Horn.

Access: Aboriginal trails became administrative trails, recreation trails, and in some cases, railroads and/or roads. One of the first roads in the watershed was a wagon road. Constructed between 1900 - 1915, this road went through Big Meadows and ended at Marion Forks.

Construction of the Oregon Pacific Railroad grade began in 1888 in the North Santiam Canyon. The train carried passengers and freight up the North Santiam Canyon until 1949 when it was abandoned above Gates due to the construction of Big Cliff and Detroit dams. Many sections of the railroad grade were used as a road and trail for people to travel. The railroad opened up the Upper Santiam canyon and brought jobs and people into the area.

In 1926, a road was constructed from Niagara (roads end) to the old town of Detroit. People now had another means of travel other than by train, foot, or horse. However the road was tough to negotiate, with several one-way passages so people still preferred the railroad to the newly constructed road.

In the early 1930's an attempt was made by President Roosevelt to get the U.S. out of the Depression. One objective to accomplish this was to put people back to work in labor jobs. One of the work projects included the hiring of crews to build better roads. As a result, the road system began to expand up the major drainages, mainly on the east and north sides of the North Santiam River. Circa 1935, a highway was constructed from Detroit to the Santiam Junction. Private lands along Boulder Ridge and Whitewater were the first areas to become accessible. Roads were also constructed to allow for easier access to the more popular high lakes, primarily Marion and Pamela. Road building followed close to the streams and involved little more than the widening of existing trails.

By the mid 1960's roads had been built into all the major drainages on federal land. The collector roads were being tied together to establish a network joining the Upper North Santiam to its neighboring watersheds. Road miles increased as the demand for timber increased through the 70's and 80's.

Recreation: As early as 1900, high country adventurers were interested in this area, including mountain hiking clubs. Conflicts arose between the people who supported the preservation of the early forest reserves and sheep grazing in the high country.

Recreation use increased in the 20's and 30's coinciding with citizens owning cars. The Forest Service issued special use permits for summer homes and built trail side facilities and campgrounds to encourage recreation use. In addition to expanding the transportation system, the Civilian Conservation Corps built campgrounds, surveyed summer home sites, built trailside shelters and reconstructed trails to be compatible for recreation use.

In 1933 the Mt. Jefferson primitive area was the first area set aside on the Willamette National Forest coinciding with an on going interest in high country recreation and protection of its values. Portions of the Oregon Skyline Trail were relocated for better views, and to provide a direct north-south route. The National Trails Act provided “instant” designation of the Skyline trail which was renamed Pacific Crest National Scenic Trail.

Mt Jefferson Primitive Area eventually became Mt. Jefferson Wilderness and included additional undeveloped areas inventoried through RARE. Although there were many recreation facilities within the new wilderness, they were ordered removed to meet the spirit of the area. Marion Lake had numerous facilities and high use. Managers found it difficult to scale back this established use to a level consistent with that required by the Wilderness Act.

After the 1950's recreation habits changed, car camping and eventually RV camping became more popular. There was also an increase in the demand for skiing and other types of specialized recreation, leading to the kinds of opportunities in the watershed today.

Socioeconomic: Commercial use of the watershed increased as the area became more accessible. In addition to timber fueling the local mills, many residents have used the land for sustenance hunting, fishing, and firewood gathering.

The local economy within the canyon has gone through boom and bust cycles since the 1940s, and is very closely tied to a timber economy. Dependence on timber fueled if not caused the boom and bust cycles of the economy and consequently the local economy is sensitive to changes in land forest policy.

Beginning in the 1960s, increasing conflicts arose as land policy changed. The steady increases in timber cut and the steady increases in recreation lead to increased conflict over the management of national forest land.

Sustainable Communities / Current Condition:

The drastic reduction in forest commodities beginning in 1990 has forced communities to look at options for timber to supply the mills. Rather than moving out of the area, the local mill owners have traveled long distances for wood for their mills.

Firewood is a forest commodity used by local communities which has been provided historically from the Upper North Santiam. Even though public demand for firewood remains high, our ability to fulfill the need has diminished steadily since 1992 with the reduction of timber harvest.

Between 1985-1990, approximately more than 150,000 cords were sold from the watershed and in 1994 only 850 cords were sold district-wide. Since 1993, public demands for firewood been unfulfilled.

Firewood availability will likely be consistent with levels of large woody material (see map 13) in this watershed without natural events such as blowdown or wildfires. Firewood will only be available where current and future needs for LWM are met in the area. This standard is described generally as 240 lineal feet of down wood per acre, greater than 20 inches in diameter and decays class I or II. In addition, the current Forest Plan for WNF restricts firewood gathering in several land allocations such as wilderness.

(SR1a) Products to Diversify Local Economy: The North Santiam watershed has several non-traditional forest products available to private businesses. Such items fit very closely with the North Santiam Canyon's strategic plan for economic development. A key item in the plan is to encourage diversification of forest products either through secondary wood products manufacturing or through new markets in non-traditional forest products. With regard to the latter, the community received a grant to study the market opportunities and to develop a methodology for companies and government agencies to evaluate available sustainable supplies of these products.

Special forest products may have a variety of effects on vegetation depending on the nature of the activity or the level of harvest. In some cases, harvesting is used to meet silvicultural objectives and uses similar techniques such as thinning or pruning to generate products.

Since there is a wide variety of existing and potential products, it is difficult to generalize as to their specific effects. A potential list of products includes boughs, Christmas trees, beargrass, sword ferns, salal, prince's pine, mosses, Oregon grape, clippings of various shrub species, huckleberries, mushrooms, tree cones, posts and poles, shakes, and firewood. Benefits and effects of product removal may include:

- Stocking control of trees, thinning and post and pole harvest, which may increase tree growth, reduce canopy closure and stimulate understory vegetation.
- Pruning which may reduce canopy closure and stimulate understory vegetation, increase future wood quality, reduce blister rust frequency on white pine and sugar pine, and improves nutrient recycling early in the stand cycle.
- Clipping of plants may increase new shoot growth which may either reduce competition to other plants or provide available forage for animals.
- Whole plant removal may reduce competition for other plants.
- Plant removal, pruning, and clipping may be used to reduce vegetative encroachment on roads, trails, or other sites.
- Provides employment, economic diversity, and revenue to the Government.

- Allows for harvest for personal use.

Access and Travel / Current Condition:

Highway 22 provides the most direct route and is a major east west corridor between the northern Willamette valley, including the cities of Salem and Portland, and the fast growing central Oregon city of Bend and it's surrounding communities. As these communities grow there will be increasing use of the highway corridor through this watershed.

(AT2a) Safety Concerns: During the 1994 North Santiam Watershed Assessment, ODOT identified many large, deteriorating trees that pose a potential safety hazard to public users along the highway corridor.

In addition to the hazard trees other safety concerns include lack of highway signs identifying the junctions of major collective roads; no left-hand turn lanes for campgrounds directly off the highway; short sight distances at some highway junctions; narrow highway bridges; heavy congestion associated with a variety of uses at the community of Marion Forks; some passing lanes in poor locations; and unmarked dispersed recreation sites.

(AT2b) Coordinate With ODOT On Highway Improvements: The Forest Service has never established a right-of-way with the State for the highway location. All land directly adjacent to the highway that is not privately owned is federal land. Currently ODOT and the Forest Service operate under a Memorandum of Understanding (MOU) to coordinate the needs of the Highway with Forest Service requirements. Under this MOU, ODOT is able to do most normal maintenance activities such as patching, line painting, ditch cleaning without informing the Forest Service. When ODOT plans pavement overlays, pipe replacements, falling of hazard trees or other activities which could impact our resources they coordinate with Detroit Ranger District personnel. Currently the Region 6 is working with state highway agencies to establish easement agreements for all highway corridors within National Forest Land.

Oregon Department of Transportation prints a publication titled "Statewide Transportation Improvement Program." From the preliminary document dated 1995-1998 two projects have been identified in this watershed. First there is a surface preservation treatment scheduled for 1996 from mile point 55.0 through 62.3. This is near Pamela Creek. In 1998 the Whitewater bridge has been scheduled for replacement. There is not much detail given in the description of work. ODOT funding, like the Forest Service's, can be erratic and scheduling can generally be depended on to change regularly.

Opportunities exist to establish a cooperative working agreement with ODOT to look at long term needs of the highway corridor that will be mutually beneficial.

(AT1a) Access Needs: Current access to recreational opportunities and to forest management activities is adequate. Management activities most affected by access are fire suppression and prevention activities, and access to managed stands for special forest products. Some roads are closing themselves due to decreased road maintenance budgets, so access is expected to become more difficult in the future.

Recreation / Current Condition:

Good access due to relatively flat terrain, and the unique features within this watershed has created a wide range of recreational uses. The most intensive recreation use is concentrated on waterways, trails and roads.

Wilderness: The Mt. Jefferson Wilderness received approximately 33,122 visitors in 1994. The area is easily reached by many roads to entry points, several less than one mile from the wilderness boundary. The combination of easy access and proximity to large population centers has resulted in high day and overnight use. Approximately 63% of the visitors are day users. Easy access to popular areas has lead to intensive use. Intensive use has subsequently resulted in resource and social impacts that have impeded the attainment of wilderness management objectives.

(SR5a/b) Resource impacts: The 1988 Limits of Acceptable Change (LAC) campsite inventory indicates that out of 865 campsites, 43% of the sites have exceeded acceptable standards for vegetation loss in campsite area (barren core area). In addition, 63% of the sites have tree damage or loss in excess of acceptable standards. Consumption of down wood for campfires has far exceeded the rate of natural accumulation. The scarcity of campfire wood has resulted in visitors cutting down and excessively damaging standing green trees.

Nearly all riparian areas accessed by trails have been impacted by camping. Many campsites are exceeding acceptable standards for proximity to streams, lakes, and trails.

In "key impact areas" of intensive recreational use, 56% of the campsites have composite impact ratings of "heavy to extreme." These areas have priority for study and implementation of Wilderness Management Strategies including restoration, regulations and restrictions.

The inventory of wilderness campsites suggests that scenic quality and user experience within most opportunity settings have been affected by the conditions noted. While wilderness campsite conditions may diminish the intended user experience, they represent little or no effect to downstream water quality. However, in high elevation environments, the conditions noted for many wilderness campsites may require significant time for recovery of denuded riparian vegetation, consumed down woody debris and compacted soils.

(SR5b) Social Impacts: Three general destination zones, Marion Lake, Jefferson Park, and Pamela Lake/Hunts Cove, exceed acceptable encounter standards on both weekends and weekdays. Duffy Lake, Eight Lakes Basin, Santiam Lake and Maxwell Butte areas exceed acceptable standards on weekends but not weekdays.

Mowich Lake and portions of Jefferson Park area exceed acceptable standards for the number of groups camped within sight and sound of each other at least 80% of the time. Duffy, Santiam and Marion Lakes are near to exceeding acceptable standards for camp solitude. Far more campsites have been created than are needed to accommodate use on any one day.

(SR5b) User Conflicts: Conflicts within the wilderness surround the issue of solitude and the different perceptions of what a "wilderness experience" means to an individual. Conflicts exist between horse users versus non horse users. At both ends of the continuum, members of each user group would like an experience void of the other groups' presence. Some hikers feel that horseback riding is not an appropriate activity within the wilderness setting, and have at times made hostile comments to horse users. Not all horse users are seeking opportunities for solitude but enter the wilderness because the facilities or trails are available.

Marion Lake attracts many groups of people that like to have remote loud parties which disrupt those users that are seeking opportunities for solitude.

Other conflicts that occur are those that violate wilderness regulations and detract from user experiences, including mountain bike or trail bike use, caching of equipment, and group sizes exceeding the maximum of 12 people per group. Large groups, by their nature, have a disproportionately negative impact on opportunities for solitude in wilderness.

Dispersed and Developed Recreation sites outside of the Wilderness: The 1964 flood brought changes to recreation areas along streams within this watershed. Three campgrounds were destroyed. With tighter budgets, the direction was to build fewer but bigger campgrounds and concentrate more people in specific areas. Numerous small scattered campgrounds were considered inefficient and a higher risk for potential human ignited fires. Campgrounds were also built larger to meet projected growing demand.

(SR5a/b) Dispersed Recreation Outside of Wilderness: Dispersed recreation opportunities within the Upper North Santiam can easily attract in excess of 100,000 visitors every year. Peak use of dispersed sites is primarily during the summer months, June through October, with big game hunting activities occurring into the fall. Peak use of dispersed winter recreation occurs during good snow conditions in December through April.

Based on observed conditions at 214 inventoried dispersed campsites in the Upper North Santiam, dispersed camping use predominately occurs along the North Santiam River where access is relatively easy to level areas near water. In some cases lengthy access roads and trails have been developed by users to reach desirable sites along the river. Other dispersed campsite concentrations which have a high frequency of use occur around lakes such as Fay, Pika, Fir, Presley and Tule; trailheads primarily Duffy and Pamelaia; and streams including Marion, Puzzle, Moon, Downing and Whitewater Creeks.

The inventories also indicate that at least 29% of the sites experience substantial site degradation in excess of the norm. These are considered heavily or extremely impacted sites. Conditions of the most heavily impacted campsites include: soil compaction, erosion, large barren core, vegetation loss, tree damage and developments. Many hazard trees have been created as a result of recreation related activities.

Twenty dispersed horse campsites exist within the watershed. Of these, 15 sites are considered heavily or extremely impacted. Many of the large sites that have a cluster of campsites are often occupied by large groups. Generally, campsites occupied by large groups tend to have more resource impact to the site than small groups or individuals.

Popular campsites that receive intensive use generally suffer from greater damage. Vehicular access to sites is not limited, which attributes to some of the degradation of these sites. Another contributing factor to the condition they exhibit is the level of use individual sites receive each season due to their popularity or proximity to specific areas of interest such as the North Santiam River.

Dispersed site conditions within the watershed exhibit other characteristics that are a function of visitor behavior. It is common to find human waste proximal to dispersed sites. In addition, often debris associated with the camping experience are left behind at the site. This residue poses a threat to the health and safety of the visitors present, particularly during periods of peak concentrated use. However, due to the relative short duration and seasonal nature of this use and the scale of the total watershed, these conditions do not have a measurable effect on downstream water quality.

(SR5b) The presence of human waste and debris, tree damage and loss, denuded and compacted camp areas, suggests that both the scenic quality and the intended recreation experience have been diminished for a significant number of sites within the watershed.

(SR5a/b) Developed Recreation: Developed sites in the Upper North Santiam include four Forest Service campgrounds, two winter shelters, 17 recreation residences, two trailheads with restroom facilities, one organization camp site, and one private club site.

Current use of developed recreation sites in the Upper North Santiam watershed is estimated at 53,958 recreation visitor days (RVD's) or 85% of available practical use capacity. Practical capacity is an expression of the maximum amount of use considered appropriate for well-managed sites. Use in excess of this amount would typically result in adverse impacts to resources, site facilities and user satisfaction.

Camping at one of the four Forest Service's developed campgrounds (Whispering Falls, Riverside, Marion Forks and Big Meadows) accounts for an estimated 27,174 visitors annually. Presently, Forest Service campgrounds are not on a reservation system. Campgrounds, primarily Whispering Falls, Riverside and Mountain View Park receive the overflow from the Detroit Lake Area. As campgrounds around the lake get full, visitors seek campgrounds or dispersed sites along Highway 22.

Currently, practical capacity has been achieved at Whispering Falls Campground for a variety of reasons. During peak season in the summer, the campground reaches in excess of 100% capacity on the weekends and becomes completely full many times during the weekdays. The campground's entrance is located on a bend on Highway 22 which has limited site distance and poses serious traffic safety concerns. In addition to the overnight use, Whispering Falls and Riverside campgrounds receive high day use such as picnicking and use of the restrooms by highway travelers.

Big Meadows Campground is a small horse camp with nine sites, which often exceeds maximum use capacities during peak weekends in the summer, holidays and during hunting season. Since the campground does not provide a reservation system, many groups are displaced to dispersed sites within the Big Meadows vicinity. Horse camping tends to be a social oriented activity so large groups are very common. In many instances "site saving" has become a problem, due the lack of a reservation system and the sizes of the groups that use the campsites.

Developed sites are vulnerable to vandalism at times, and receive normal "wear and tear" through use and age, and incidental damage from weather events. Many of the pit toilets in campgrounds are old and in need of replacement. For a complete list of facilities in need of maintenance or replacement refer to the Facility Condition Assessment in Recreation Resource Information System (RRIS).

Recreation special use sites, Marion Forks summer homes, Chemeketan Outdoor Club Cabin, and Camp Pioneer Boy Scout Camp, have long achieved practical capacity due to their high demand and use patterns. These special use sites account for 13,210 visitors annually.

(SR5b) User Conflicts: Whispering Falls and Riverside campgrounds receive high day use by visitors that conflict with the overnight users. Day users tend to tie up campsites along the river for their activity which has on occasion upset the overnight users coming into the campground wanting to set up camp at those desired locations. Due to the lack of any day use/rest area facilities along the highway, many highway travelers take advantage of the rest room facilities and campsites at these two campgrounds, predominately Whispering Falls. The amount of use above what the campground was designed to accommodate, indicates that overnight user satisfaction may be diminished.

Conflicts between horse and nonhorse user groups exist at Big Meadows Campground. As nonhorse user groups occupy the campsites, groups with horses cannot take advantage of the horse facilities provided and are displaced to alternative dispersed areas.

(SR4b) Conflicts between recreation and other uses occur within localized areas within the watershed. Many of these conflicts can be taken care of by our management activities. For instance, work on some contracts have been suspended during peak recreation weekends.

During the NEPA process on site specific projects, conflicts will be addressed. Some of the conflicts include:

- Camp Pioneer warrants special note in regard to its use and conditions. The Boy Scout camp is located in the mountain hemlock zone around Pine Ridge Lake which has severely compacted soils due to the years of use. Although not a key contributing factor, the stress placed on the trees as a result of compaction and exposed roots has made them more susceptible to Western spruce budworm defoliation and mortality.
- Adding structure to streams in popular kayaking areas

Scenic Resources: Existing conditions within no harvest allocations meet Scenic standards and guidelines. The existing conditions for management areas 10d, 11c, 11d, 11f, and 14a, exceed respective decade harvest rates but do not exceed the Forest Plan standards for maximum disturbance. Management areas 10b and 11a have disturbed conditions below the decade harvest rate.

Although harvest activities are currently consistent with Forest Plan standards, the sizes, arrangements, and geometric character of treatments over the past fifty years have had a lasting effect on the scenic quality of the area. The visibility, distribution and concentration of various treatments are in contrast with older uncut stands, contribute significantly to the current quality of the scenic resources. Currently 83 stands exceed Forest Plan standards for maximum created opening sizes due to regeneration harvest activities. Total acreage of these stands is 3,600 acres. This represents the worst case scenario. It is suspected that many of these stands have since recovered and are not considered "open."

To the casual viewer, the Existing Visual Condition of the landscape in the Upper North Santiam can be described as Natural Appearing within the Mt. Jefferson Wilderness and Slightly to Heavily Altered outside of the Wilderness.

Heritage Resources / Current Condition:

(SR2b) Tribal Rights: Rights of Native American Tribes stem from treaties signed by both the Native American tribes and the U. S. Government and thus there has been established a special government to government relationship between the tribes and federal agencies. The treaties established land in four levels of interests by NW Indian tribes:

- Priority 1 - Reservations
- Priority 2 - Ceded lands with their location and rights specifically identified
- Priority 3 - Usual & accustomed lands with location and rights not specifically identified
- Priority 4 - other Pacific Northwest lands based on historic use and homes of the Confederated Tribes of Warm Springs (CTWS) and based on unique language in their treaty.

The North Santiam watershed falls within the Priority 3, Usual and Accustomed lands. The CTWS reservation borders the watershed along the crest of the Cascades from near Goat Peak north to the northern boundary of Whitewater subdrainage. There may be a sliver of CTWS reservation land in the watershed near the crest of the Cascades and north of Mt. Jefferson, but would need surveys to establish the line. Regardless of ownership, there would be no difference in management of that land. Other tribes of the Grande Ronde may also have rights stemming from past usual and accustomed use.

(SR2c) Forest Practices and Tribal Objectives: CTWS has expressed a significant interest in how the Mt Jefferson Wilderness is managed with special emphasis on ease of access to the northern portion. Wilderness users at times encroach onto the reservation in the area just north of Mt. Jefferson and some of those users leave trash and generally abuse the wilderness.

(SR2a) Sites Significant to Native American Tribes: Some patterns of past Native American use have been established based on discovery of cultural sites. Primarily, this has been along ridgetops and along streams. However, there is continual effort to work with the tribes to further define their treaty interests stemming from past usual and accustomed uses.

(SR3a) Heritage Resource Sites: A total of 22,220 acres has been field surveyed for the location of heritage resources. Based on the Heritage Resource database, 138 cultural properties (prehistoric/historic sites) have been recorded within the North Santiam watershed. Nearly eighty percent of the recorded sites have been impacted mainly from road construction, timber harvest activities, and recreation development projects. The degree of disturbance ranges from minimal to major alterations to the site's character and context.

Three factors play into the high percentage of site degradation: 1) Natural environmental influences and animal activity; 2) Visibility within the Western Cascade forest environment is not always conducive to finding undisturbed sites; and 3) Prior to 1978 sites were not inventoried, recorded or protected.

Most sites have incurred varying degrees of site degradation through root production of plants and trees, trampling by game animals, burrowing by small mammals, erosion and freeze thaw cycles, and wind thrown trees.

Site discoverability is greatly influenced by visibility factors. The western Cascades forest has very dense understory brush and a thick duff layer of moss. These conditions create a challenge for the surveyor when it comes to site discovery.

Prior to the late 1970's the Forest Service showed very little interest in past human activity. District personnel collected some data on site locations encountered in the field while accomplishing their other duties (Rakestraw 1990). Beginning around 1978-1979 site discovery has been accomplished through systematic surveys for a broad range of ground disturbing projects. This resulted in a dramatic increase in the number of sites located and recorded. In turn, measures were recommended to protect historic values inherent in these properties.

Sixty eight percent of the sites are located near or adjacent to Class I, II, III, or IV streams and 32 percent of the sites are located near or adjacent to a lake/pond, marsh, or spring. The sites appear to be located predominantly near or adjacent to a class II or IV streams.

BIOPHYSICAL CONDITIONS

Aquatic Systems:

Stream Conditions: Historically, the productive capabilities of the streams were probably higher, due to greater amounts of large woody structure. These historic streams were well connected to their flood plains. With the construction and subsequent maintenance of the highway, and especially the 1964 flood, these streams were heavily altered. Channel areas were restricted through the use of riprap, and large wood was removed. These actions caused downcutting to occur, which steepened stream gradients in reaches of the main stem, Marion Creek, and near the mouths of major tributaries.

(FH2c) Cold Water Sources: Tributaries at all levels through the watershed are important in maintaining cool water temperatures for fish production and downstream water quality. Most of the cool water sources within the U.N. Santiam watershed are the result of ground water. Numerous cool water sources are present. The geology of the area provides permeable layers (glacial material) that cover less permeable layers (basalt lava flows). The main river canyon dissects these layers and allows surface water to appear as springs. All are important, due to the special habitats that they create and their temperature moderation potential.

One stream stands out dramatically as a temperature moderator. Puzzle creek runs 5 - 8 degrees Celsius throughout the year. Marion Creek, which is fairly wide and shallow due to channelizing and wood removal, would be a much warmer stream if Puzzle Creek didn't supply a significant inflow of much colder water. This maintenance of cooler temperatures in Marion Creek is important in maintaining high water quality for the Marion Forks Fish Hatchery.

Water Quality: Water quality within the North Santiam watershed appears to be high. No specific quality data other than temperature was available for the North Santiam River. Tributary streams, which provide domestic water to municipalities, have recorded high water quality. Records currently show that since 1950, the mainstem has an average temperature of 15 degrees Celsius for the month of July. Maximum temperatures for the station reach 19 degrees Celsius in August. These temperatures are moderated by inflow and riparian vegetation growth.

This watershed has very little management induced sediment moving through the system. Fine colloidal silt appears in Whitewater Creek during August or September depending upon the snow pack. This material is generated off the Mt. Jefferson glacier. The material colors the water periodically during these times. This material is colloidal in nature so it has minimal effect on aquatic organisms.

Habitat for Fish and Other Aquatic Wildlife: The past condition of the watershed was probably much more productive than existing conditions. Prior to road building through the flood plain of the Upper North Santiam River, flood control activities, timber harvest and stream clean out, the major streams of the watershed had much more structure, quality pool habitats, cover and higher nutrient loading to support larger populations of resident and anadromous fish. This is most true in relation to sections of the main stem of the North Santiam River, Marion Creek, and the lower ends of major tributaries that enter the river from the east and north and flow under Highway 22. Other streams, while having sections of poorer habitat, have not been affected as much by past management activities and are in generally better condition (See maps 10 & 11).

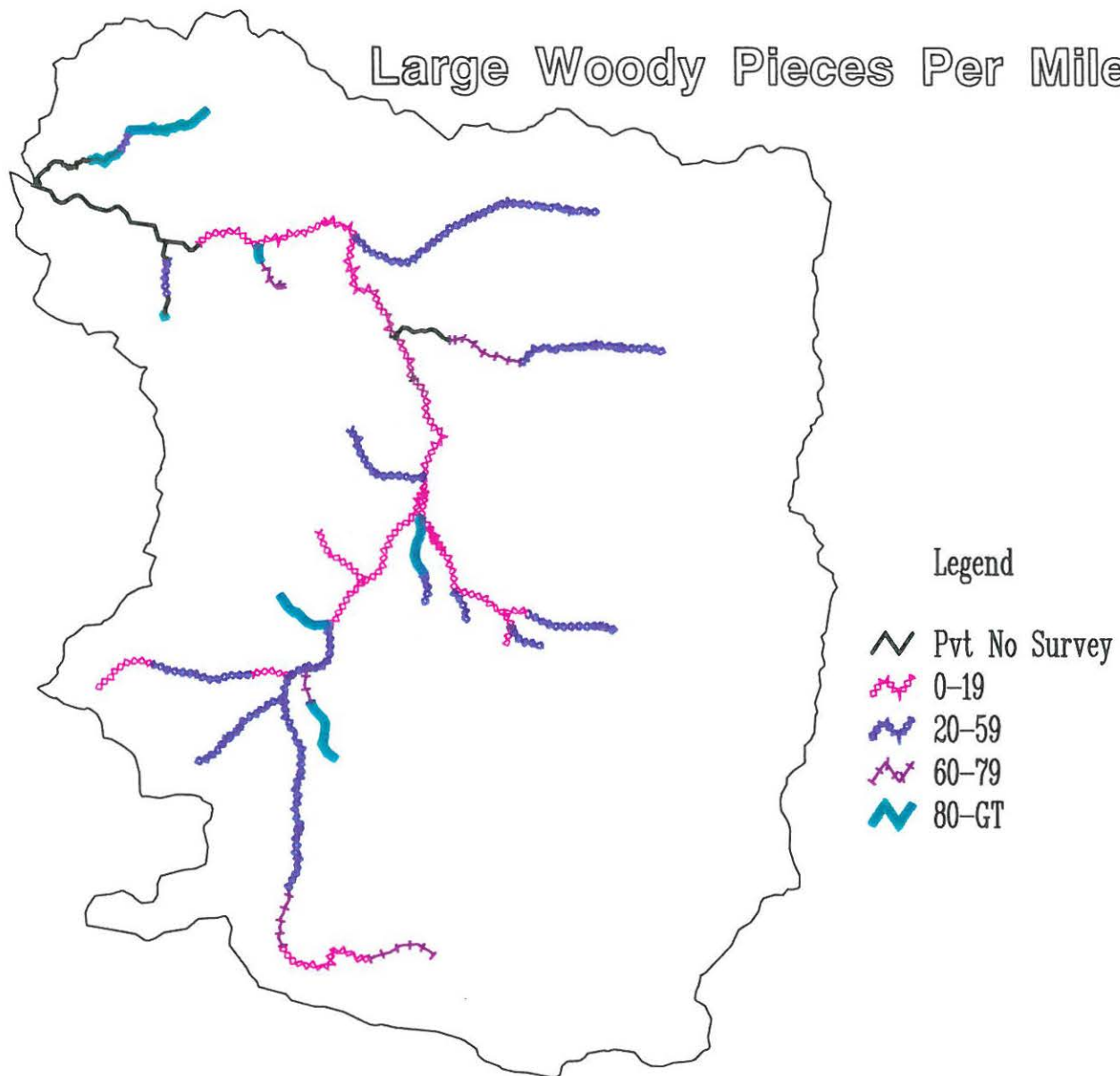
(FH1a) **Fish Populations:** Prior to the completion of Detroit and Big Cliff Dams populations of spring chinook salmon, winter steelhead, bull trout and cutthroat trout moved seasonally up and down the system. After completion of the dams, upstream migration was completely blocked for these species. Marion Forks Fish Hatchery, constructed in 1951, was built as mitigation for the lost natural production of anadromous fish above Detroit Dam.

Until the completion of Detroit and Big Cliff Dams in 1953, the decreases in native (primarily anadromous) fish populations in the North Santiam system could be attributed to downstream commercial fishing pressure, the fish racks and hatchery program from the early twenties, and diversion dams and irrigation systems in the Stayton area.






In the 1930's the Oregon Fish Commission along with cooperation from the Forest Service began a program to stock fish in all of the high lakes in the watershed. Eastern brook trout was introduced into many lakes at this time. They were well adapted to the conditions and have become a sought after game fish. This has led to present day concerns that brook trout is competing with native fish where their ranges overlap.

Bull trout historically occurred throughout the North Santiam system. The historic numbers of anadromous fishes rearing in the North Santiam River probably provided an excellent food source for the adult bull trout. The pristine, cold water tributaries with high water quality probably provided excellent spawning habitat. The adult bull trouts were most likely migratory, spending time in the lower Santiam River and probably the Willamette River when they were not running upstream to spawn. Bull trouts are fall spawners and followed the spring chinook salmon on there spawning run feeding on juvenile salmonids and salmon eggs. Bull trouts were last seen in the North Santiam River in the 1960's. It is unknown what happened to the bull trout, but their fate may be related to the dams, habitat changes, fishing pressure and a loss of a major food source, (the anadromous fish juveniles).

Large Woody Pieces Per Mile



Legend

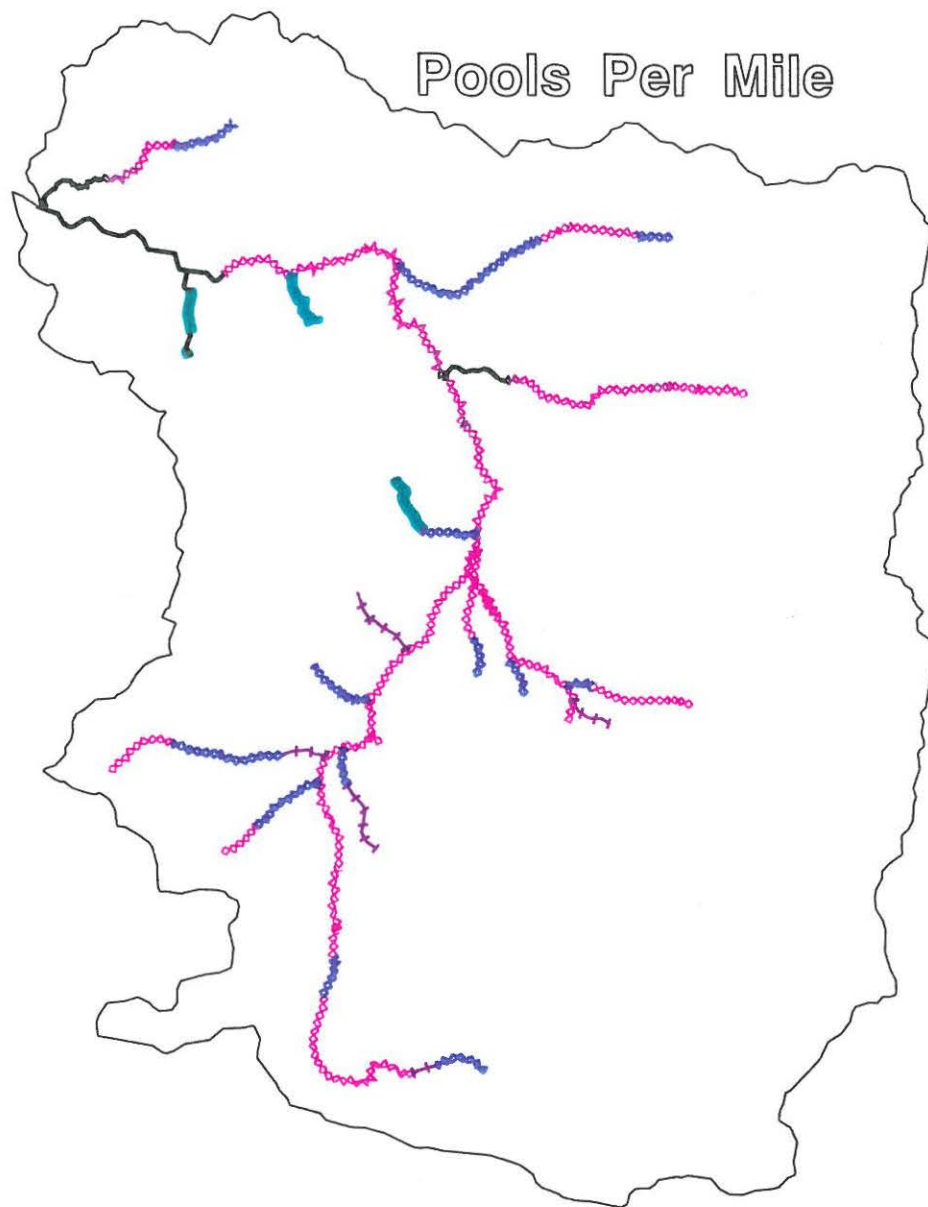
-  Pvt No Survey
-  0-19
-  20-59
-  60-79
-  80-GT



Upper North Santiam Watershed Analysis
Detroit Ranger District

Scale 1:200000
07/28/95

Map #10



Legend

- ~ Pvt No Survey
- 0-9
- 10-19
- 20-29
- 30-Greater



Upper North Santiam Watershed Analysis
Detroit Ranger District

Scale 1:200000
07/28/95

Map #11

(FH1b) Potential production of winter steelhead and spring chinook in the drainage:

Reports from the 1920's and 1930's indicate, based on egg takes for hatchery programs, that as many as 1000 to 1500 spring chinook and about as many winter steelhead were returning to the Upper North Santiam River to spawn. There are also indications from those same reports that fish stocks were depressed from earlier years. Historical numbers may have been as high as twice the above in good years.

(FH 2a) Current habitat conditions relating to the reintroduction of anadromous fish: The current productive capacity of historic anadromous fish habitats is probably much less than it was 75 years ago. There is still spawning and rearing habitat but not on the same scale and productive capability that existed early in this century. There is a high probability that portions of the main stem of the Upper North Santiam River and the lower two miles of Marion Creek are outside the historic range of natural variability due to management activities. It is difficult to equate roads, riprap, boulder berms, straightening, and years of salvage logging to anything that might have happened naturally to these two streams.

Riparian Reserves and Biological Diversity:

(FH2d) Riparian Reserve Conditions (see map 12):

Structural Stage	Seral Stage	* Acres of Riparian Reserves	% of Riparian Reserves
Stand Initiation	Early Seral	10,615	24%
Stem Exclusion	Mid Seral	17,684	41%
Understory Reinitiation and Old Growth	Late Seral	11,806	27%
Non-forest		3,256	8%
Total		43,361	100%

* acres include private land

Most riparian stands on private lands are predominately in the early or mid seral stage.

Riparian Reserves Existing Conditions



Legend

- Early Seral
- Mid Seral
- Late Seral
- Buildings & Rocks
- Meadows & Shrubs
- Water
- RR's in pvt lands



Upper North Santiam Watershed Analysis
Detroit Ranger District

Scale 1:200,000
07/28/95

Map #12

(VW1e) Effect Of Management Within Riparian Reserves On Riparian Associated Species Of Concern:

A table of general impacts to late successional species of concern is in the process of being developed at the forest level. This table is based on site specific assessment of each area, current knowledge of past projects, and known habitat requirements of species associated with these habitats. It will describe the short and long term impacts of activities such as commercial thinning, hazard tree removal, and trail construction on Species of Concern that are associated with late successional forest riparian areas. A set of mitigation measures and assumptions will be also described to assist in the development of management prescriptions during NEPA processes. The information on and the use of this table is intended as a beginning to an iterative process.

As new information is available, it will be incorporated into the table of effects and project implementation. Certainly many more species than those listed on this table use riparian areas, or would be affected by projects within riparian reserves. As results of scientific committee investigations and recommendations for new standards and guidelines become available, they will be incorporated into this guidance. The mitigation measures which are common to all projects include the required survey and manage strategy as described in the Record of Decision for amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (April 1994), as well as all standards and guidelines in the Willamette Land Management Plan (1990).

(VW1f) Wildlife Species: This watershed provides habitat for at least 290 wildlife species. Most of the habitats are associated with the Western hemlock plant association series. They are characterized as very diverse and well distributed for most species. Most species are associated with riparian and special habitats (see table 9).

(VW1h) American marten and pileated woodpecker: Riparian Reserves are intended to take the place of Management area 9C in the Willamette National Forest Land Management Plan. Outside of no harvest land allocations, there are approximately 15,000 acres of Riparian Reserves. Under current management practices, the riparian reserves in early and mid seral stages should develop into at least dispersal habitat for mature forest associated species within 50 years.

Table 9 - Potential Number of Wildlife Species by Habitat*:

Species and Habitats	Potential Number of Species	
	All Types of Use	Used Primarily as Breeding Habitat
Species use of special and unique habitats	279	247
Species use of riparian habitats	252	180
Species use of mid-late Western hemlock	145	126
Species use of mid-late Pacific silver fir	135	111
Species use of mid-late mountain hemlock	112	91
Species use of riparian Western hemlock	252	180
Species use of riparian Pacific silver fir	252	180
Species use of riparian mountain hemlock	252	180

* Based on Guilding Model estimates and includes only mammals, birds, amphibians, and reptiles.

Threatened, Endangered, and Species of Concern:

(VW1i) Northern spotted owl: Dispersal habitat for northern spotted owls is below desired levels in 29% of the watershed, primarily in the Straight landform block. Within these stands, average diameters are smaller than 11" dbh and /or have less than 40% crown closure.

Approximately 74% of Riparian Reserves currently meet 11/40 standards for dispersal habitat.

Approximately 52% of the LSR that falls within this watershed is suitable owl habitat. Out of 17 activity centers known to exist within the LSR, 46% have enough habitat to meet Forest Plan objectives.

(VW1g) Other Threatened, Endangered, and Species of Concern: A detailed description of habitat conditions and known populations is available in the wildlife report for this analysis. Table 10 displays some risk factors associated with the management of the following species.

Table 10 - Conditions that pose risks to the population or limits its distribution:

<u>Species</u>	<u>Risk Factors</u>
P.Dubium (mollusk)	Road maintenance in rockslide areas, loss of riparian habitat
Northern spotted owl	Fragmentation and conversion of late successional habitat
Marten	Fragmentation and conversion of late successional habitat, loss of large woody material
Red tree vole	Fragmentation and conversion of late successional habitat
Tailed frog	Loss of stream side habitat, increased stream temperatures
Cascade Torrent salamander	Loss of headwater, intermittent, and seep habitat

Rare Plants in the Upper North Santiam Watershed: Four plant species found on the Region 6 Sensitive Plant List have been documented in the Upper North Santiam watershed (see table 11). These species occur in non-forested habitats, such as meadows and rock gardens. Discussion of sensitive species documented in the watershed continues following Table 11. Approximately 10-15% of the Forest Service land in the watershed has been surveyed for sensitive plants, mostly in conjunction with proposed timber sales and other projects. No surveys for rare plants have been done on private lands in the watershed. Ecoplots have been characterized in the Mt. Jefferson Wilderness, but no systematic sensitive plant surveys have been conducted there.

Table 11 - Sensitive plants located in the Upper North Santiam watershed:

Common names	Scientific name	# of pops	Geographical area
Gorman's aster	<i>Aster gormanii</i>	5	Bachelor, Whitewater
Brewer's reedgrass	<i>Calamagrostis breweri</i>	1	Jefferson Park
Thompson's mistmaiden	<i>Romanzoffia thompsonii</i>	1	Whitewater
Scheuchzeria	<i>Scheuchzeria palustris</i> var. <i>americana</i>	1	Camp Creek

Gorman's aster populations in the Upper North Santiam watershed are located in the vicinities of Bachelor Mountain, Whitewater Creek, and the Three Pyramids. One population is bisected by a wilderness trail, and another is adjacent to a system trail. The latter population is included in a monitoring program, and information on its status should be forthcoming in a few years. Otherwise, all populations appear to be stable.

The documented occurrence of Thompson's mistmaiden in this watershed is located near Whitewater Creek, adjacent to private land. Recent visits have not indicated any significant change in this population.

Threats to Brewer's reedgrass mostly involve recreational use of Jefferson Park, including trampling and camping outside of designated areas. This population covers a large area, but population trends are uncertain at this time. A monitoring plan for this species will be prepared by 1996.

This Middle Pyramid population of *Scheuchzeria* consists of about 55 mats covering 1/4 acre. Threats include hydrology changes and wetland enthusiasts.

Table C - 3 Species: The locations that are documented on the Detroit District are from herbarium collections and incidental sightings. Appendix J2 of the FSEIS (Holthausen et al. 1994) provides descriptions of the habitat and range of many of these species. Otherwise, no systematic surveys have been conducted by the Forest Service for any of these species. Vascular plants that are on both the C-3 list and the Region 6 Sensitive Plant List suspected or documented to occur on the Willamette National Forest (*Botrychium minganense* and *Botrychium montanum*) have been subject to survey during the normal course of field work. To this date, habitat descriptions of most C-3 plant and fungal species are not specific enough to determine probable locations with existing data.

Besides the three incidental sightings of *Allotropa virgata* (candystick), ecoplot data reveals an additional Upper North Santiam population in the Rainbow Lake area.

Arceuthobium tsugense (hemlock dwarf mistletoe) is parasitic on western and mountain hemlocks. This species is suspected to have at least patchy distribution in the Upper North Santiam watershed; but more information is needed on locations, and is required to assess the actual threat to this species and the value infected stands have in retaining important late successional attributes. Appendix J2 of the FSEIS (1994) states that the greatest concern for this species is in the northern portion of its range (Washington State), and that the appropriateness of the mitigation measures presented needed further evaluation. In addition, a recommendation has been made to the Regional Ecosystem Office to drop this species from the survey and manage list or change its survey strategy from 1 and 2 to 4. That decision is pending.

Other Plant Species of Concern: In addition to those species that are sensitive, there are four plant species on Watch or Review Lists and three plant species on the Willamette National Forest Concern List documented in the watershed (see Botany Report).

Snag and Log Habitat: Fire and forest management activities have had an effect on the abundance and distribution of snag and log habitat (large woody material) for cavity nesters and for ground dwelling animals (see table 12a&b). The number of snags historically depended on reburns after stand replacement fires. There is evidence of reburns throughout the watershed. Today, the Parkett, Straight, Scar, and Bear Creek areas are low in snags (see maps 13 & 14).

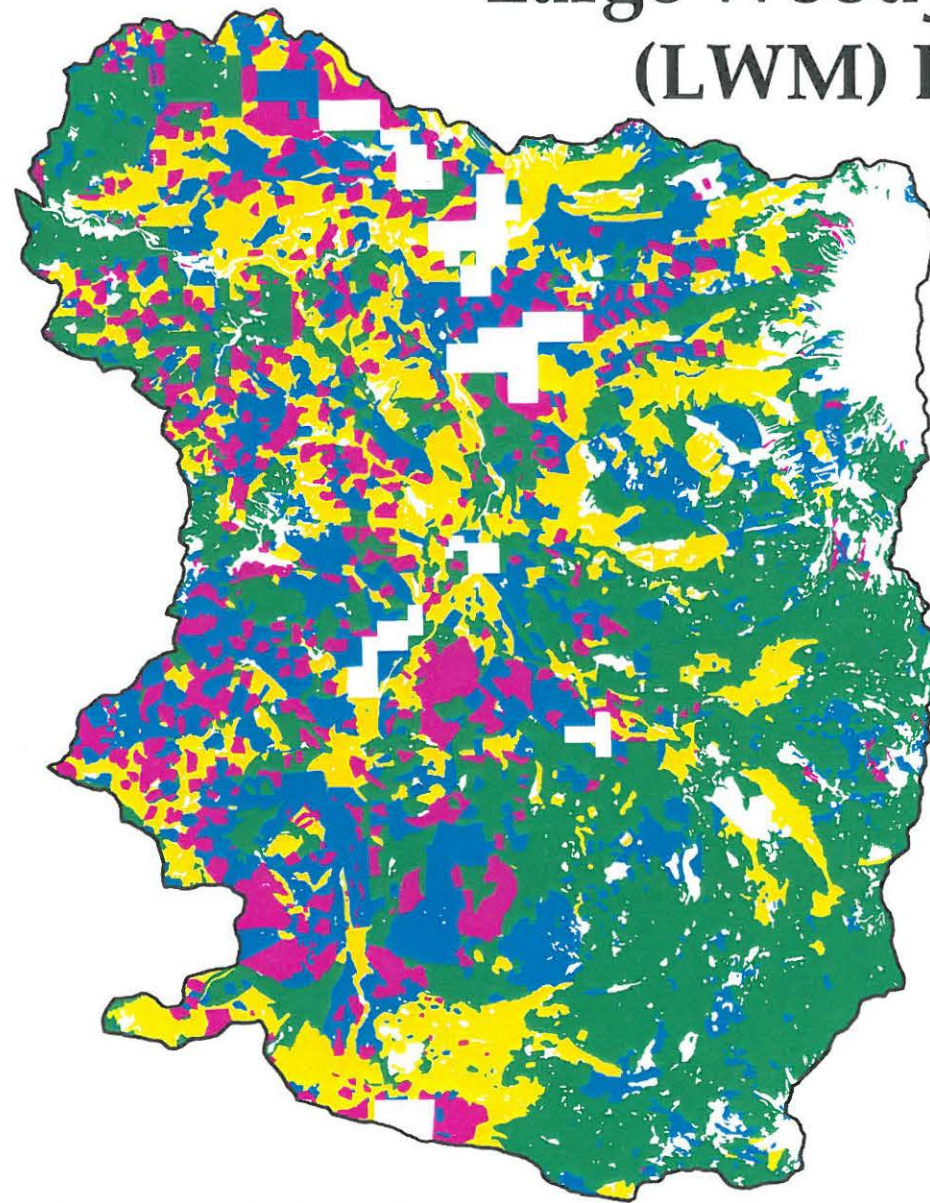
Table 12a - Current Snag Levels:

Level	Stand Condition	% Watershed
Low	Pre-1990 harvest units	27%
Low to Medium	Natural stands 9 - 20.9" dbh	38%
Medium	Post 1990 harvest units	4%
Medium to High	Stands 21 - 31.9" dbh	9%
High	Stands 32" + dbh	22%

Table 12b - Current Large Woody Material Levels:

Level	Stand Condition	% Watershed
Low	Harvest units 1970 - 1990	13%
Low to Medium	Natural stands 9 - 20.9" dbh	41%
Medium to High	Stands 21 - 31.9" dbh Pre - 1970 harvest units Post 1990 harvest units	23%
High	Stands 32" + dbh	23%

Large Woody Material (LWM) Levels





Legend

 Project Boundary

 High

 Low

 Low - Medium

 Medium - High

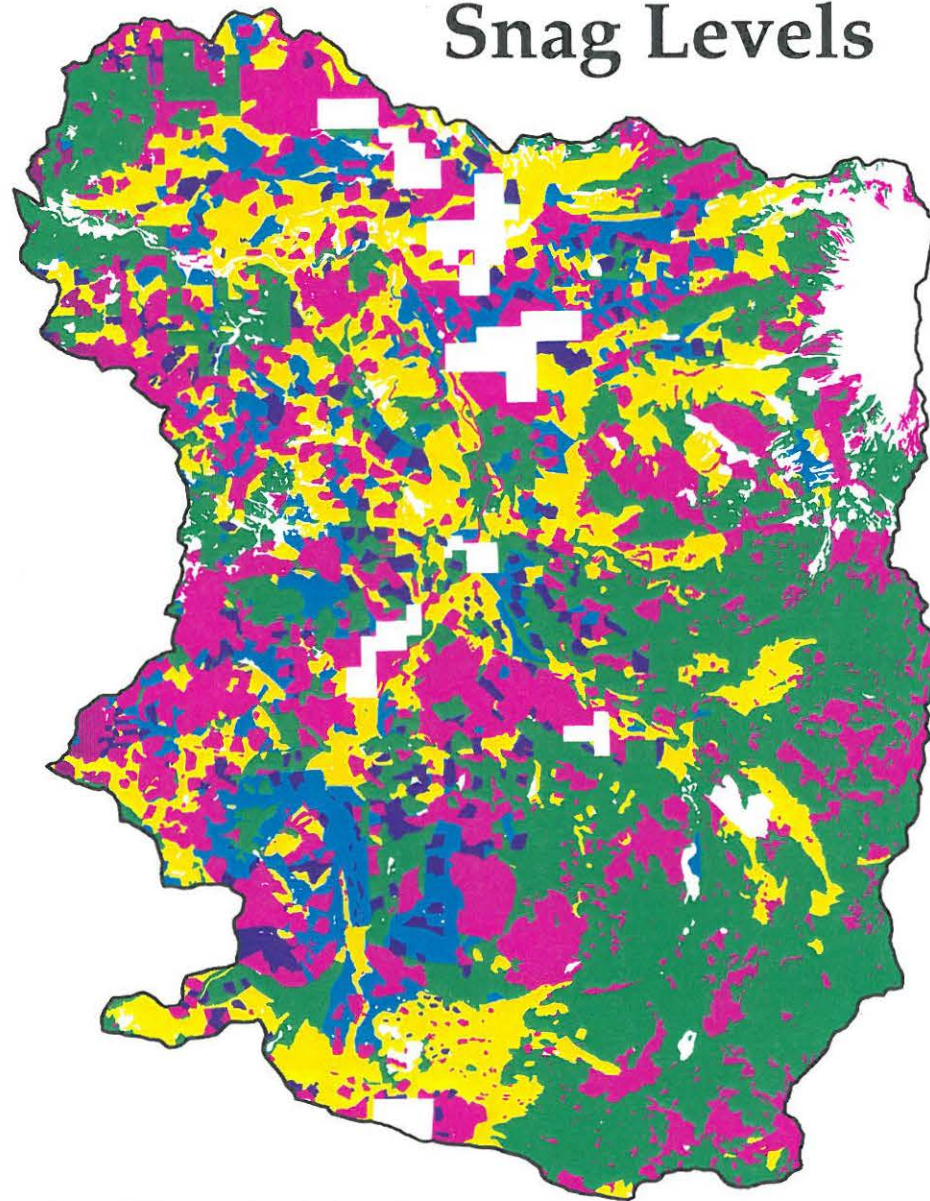


Upper North Santiam Watershed Analysis
Detroit Ranger District

Scale 1:200000
July 1995

Map #13

Snag Levels



Legend

 Project Boundary

 High

 Low

 Low - Medium

 Medium

 Medium - High



Upper North Santiam Watershed Analysis
Detroit Ranger District

Scale 1:200000
July 1995

Map #14

Special Habitats: The distribution of special habitats other than the alder/shrub types is concentrated toward higher elevations, mostly in the mountain hemlock zone. Rock, meadows, subalpine, and water habitats are particularly abundant. Harsher climate, undulating topography, and the multitude of soil types associated with the mountain hemlock zone and the High Cascade peaks provide varied habitats for a great diversity of plants and animals. The silver fir zone (mid-elevation) harbors the most alder/shrub types, and falls between mountain hemlock and western hemlock zones in the number and acres of meadows, rock, and subalpine types. The western hemlock zone (lower elevations) contains just a few more acres of water types than the silver fir zone.

Management disturbance threats to field verified special habitats appear to be harvest units and adjacent roads. An increasing trend in the number of wet meadows surrounded by harvest units and adjacent to roads, and in the number of moist meadows surrounded by harvest units and containing invasive nonnative plants could cause an irretrievable local loss of specific plant communities. Management created openings will increase the exposure of meadows and wetlands to fluctuating wind, sun, precipitation, and temperature conditions that alter the microenvironment which in turn can alter species composition and distribution (Chen 1994).

Roads represent permanently disturbed created openings that foster establishment and long term occurrence of invasive weeds, and harbor propagule sources for further weed expansion. The result is reduction and displacement of various stable native plant communities represented in the landscape.

The occurrence of special habitats (non-forested communities) and their distribution across the landscape is important for biodiversity of plant and animal species. Hickman (1976) estimated that 85 percent of flowering plant species in the central western Cascades are found in non-forest areas such as rock outcrops and meadows, which only comprise about 5 percent of the land base. The forest land management plan standard and guideline FW-211 (WNF 1990) directs us to protect these habitats and their ecotones.

(VW1c) Nonnative Plants: Three new invader species and five established noxious species occur in the Upper North Santiam watershed (see Botany Report). Spotted knapweed is found in areas adjacent to Highway 22. This species dominates large tracts of land in drier habitats east of the Cascade crest. The spread of this species to west Cascade forests is most likely due to recent drought conditions on the west side and increased transportation and recreation activities occurring across the Cascade crest.

Because spotted knapweed spreads quickly, resists conventional control methods, and threatens Willamette Valley agriculture, many sites across the forest will be hand sprayed with Rodeo herbicide in June 1995 (WNF 1995). Six of the eight spotted knapweed sites to be sprayed on the Detroit District occur in the Upper North Santiam watershed. Two other new invader species, yellow toadflax and giant knotweed, have also been located in disturbed areas near Highway 22.

Noxious weeds and invasive nonnative plants are a threat to native plant diversity. These species are able to thrive in a new environment because they arrive without the complement of predators, disease, and other ecosystem components found in their native region of the world. Most of these species take advantage of disturbance gaps such as logged units, roads, rock quarries, the areas surrounding human structures, and trails. Once established, these populations can serve as a seed source for further dispersal, generally along road and trail corridors.

Soils:

Soil Productivity/ Organic Matter: The most nutrient rich portion of the forest soil horizon is the duff / topsoil layer. Because of the active fire history and the large size and complexity of these fires, there is naturally a wide range of down decomposing organic matter. Within the areas of the most frequent and recent fires, very little duff retention and down woody debris remain from fires about 100 years ago. Some old growth stands, on the other hand, have much more down decomposing organic matter. It is likely that these stands did not burn or underburn in the fires of the last century.

The Mary landform block has some of the most productive soils in the watershed. The low elevation, north aspects, and good moisture retention combine to form considerable site II and site III land. The moist, deep soils are a result of the land flows within the area. Although this area is the most unstable within this watershed, the instability is localized.

The last 40 years of forest management tend to coincide in a general way with natural organic matter accumulation. Some areas were left with heavy amounts of slash, while others were stripped clean. Meeting standards and guidelines for duff retention and large woody debris should provide for adequate nutrient cycling in the future.

Compaction: The natural density of the soil results from several competing forces, which include rainfall, snow loading, freeze and thaw, and root growth. Tractor logging through the 60's and 70's aggressively compacted soils above and beyond these natural levels, especially in the Meadows landform block.

Compaction from tractor logging has likely affected soil productivity, and the Meadows block likely exceeds regional guidelines for cumulative compaction. Fortunately, the soils that were compacted are some of the most resilient. To reduce compaction from past management, we now require designated skid roads, and often subsoil these skid roads to break up compacted soils.

Today, the major source of most compaction is ground based skidding equipment used during periods of higher soil moisture. Fortunately, unrestricted tractor yarding and tractor piling have not been considered options on those land types where side slopes are gentle enough to support tractor logging for almost a decade. Proper implementation of existing Forest standards and guidelines should ensure that compaction does not recur.

Slope Instability: Slump / earth flow activity is not now a major factor in basin morphology. In most localized areas of larger scale, active slope instability associated with slump/earth flows have yet to be directly harvested and can be easily avoided.

Indirect effects from drainage and evapotranspiration changes are not readily apparent at this point. Actively unstable, potentially highly unstable, and marginally suited terrain has been eliminated from most management considerations. Silvicultural practices, (precommercial thinning, commercial thinning in previously harvested unstable areas) would benefit the site if the final objective is a well stocked, thrifty stand. Other than portions of the Mary and Straight landform blocks, slope stability is not an issue.

Vegetation:

High variability of vegetation is one of the unique features in this watershed. Large stand replacement fires, underburns, and weather conditions after fire has affected vegetation development. For example, more Douglas-fir developed where there were dry conditions after these fires.

These fire patterns created large blocks of early seral habitat, and left large blocks of late successional habitat. Historical vegetation patches were larger and better connected than they are today. Timber harvest has fragmented the large blocks of late successional habitat protected from large historical stand replacement fires.

Wildlife populations respond to vegetation over time. In the past, islands or blocks of habitat usually remained after fire, acting as refugia for mobile species.

Past and Current Vegetation Conditions:

The graphs and tables that follow this page represent the changes in stand structure that currently exist in the watershed compared to the stand structure that existed in 1895 (see chart 2 and table 13). As a point of reference, there is information based on an assessment for the entire North Santiam River Subbasin for the period 1600 to 1850. Structural stages and acreage were derived from stand class data stratified by plant association series and based on historical maps. In the mountain hemlock series, for current conditions, it was difficult to develop a consistent relationship between size and age since stands in the small size class (9 to 20.9 inches dbh) can range from the stem exclusion stage to old growth.

Current Stand Conditions by Structural Stage:

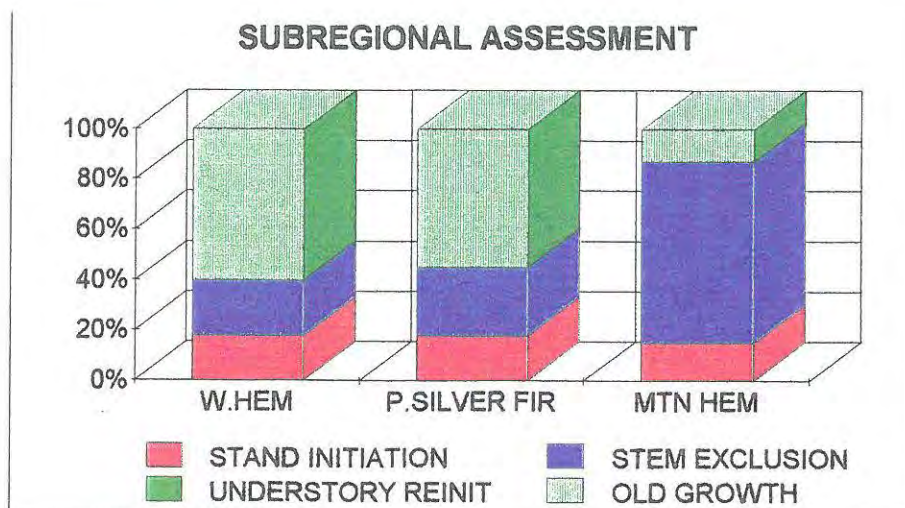
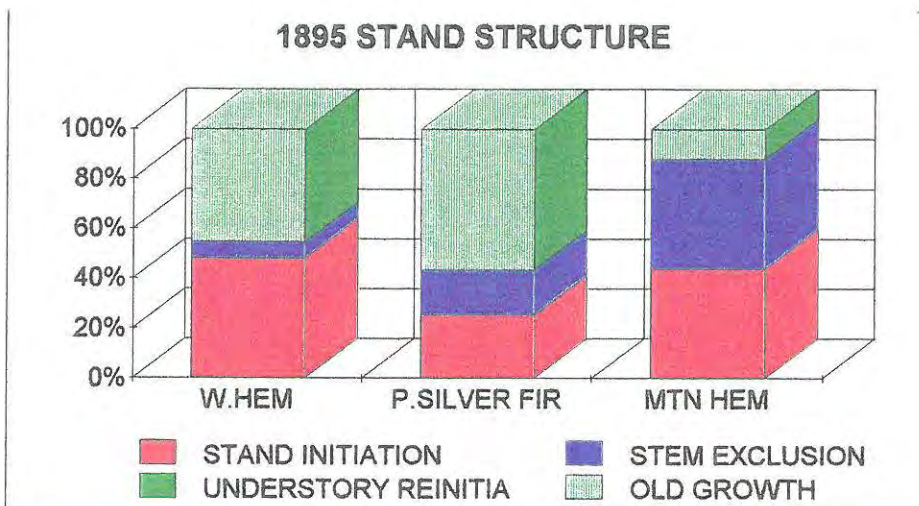
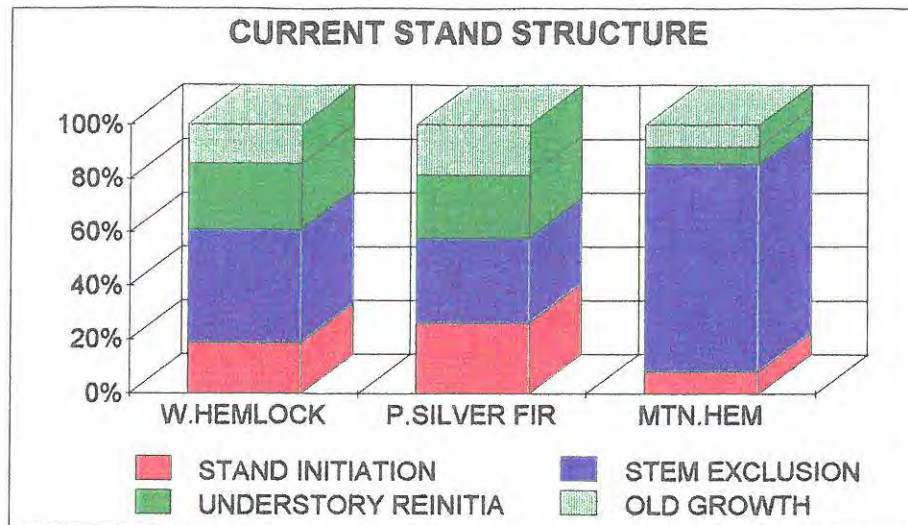
Stand Initiation Stage - Almost all stands in this stage are a result of timber management activities and the vast majority of these stands were planted. Stand ages range from 1 to 20 years and have been planted with one or more tree species. Precommercial thinning has been completed on about 1/3 of these plantations. The amount and species of non-tree vegetation are highly variable. Many of the sites in the mountain hemlock series undergo very little change in composition of plant species following fire or logging.

Until about 1990 most of these plantations had very few snags, green trees, or significant levels of course woody debris. Almost all were broadcast burned. After 1990 most units in this stage have met the Willamette National Forest standards.

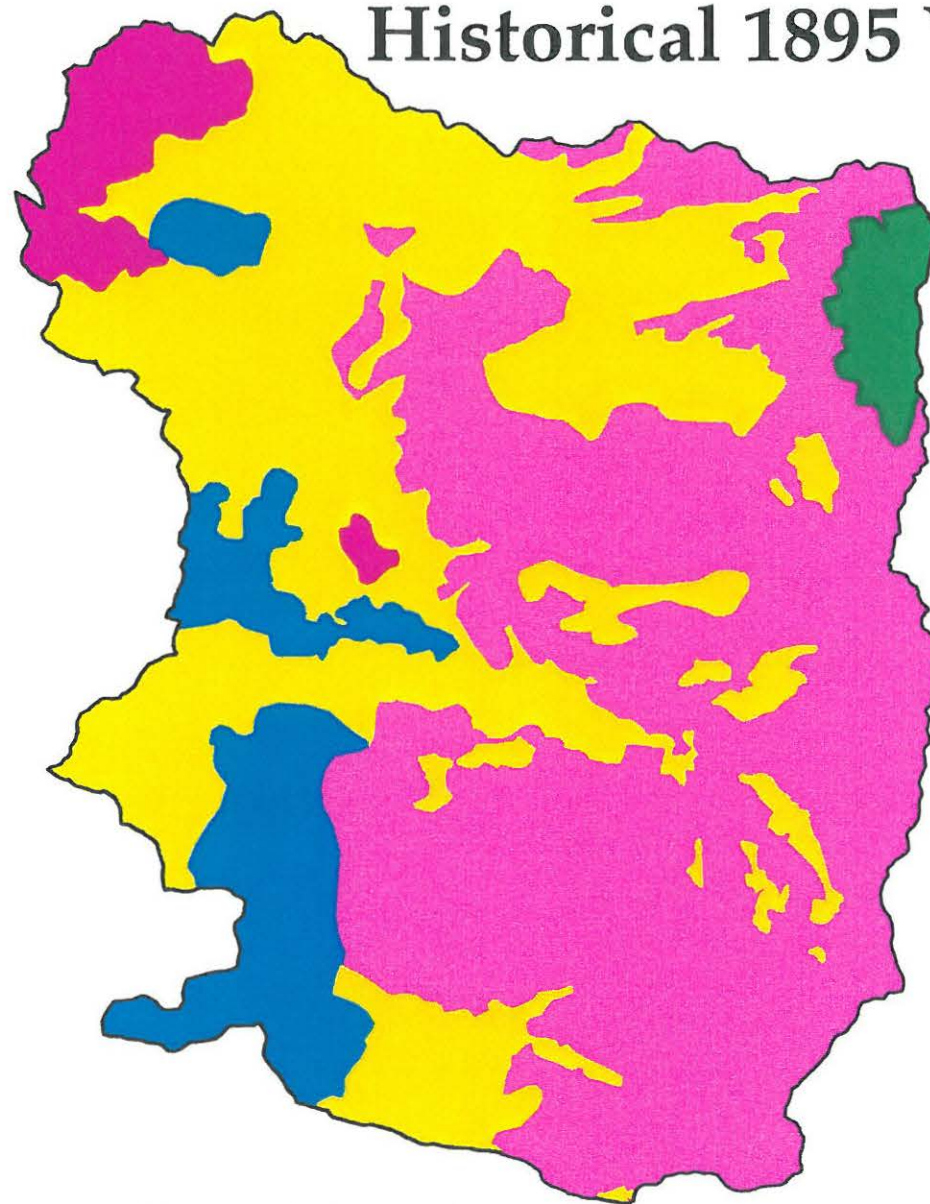
Stem Exclusion Stage - Approximately 80% of stands within this stage are natural stands. This structure stage includes a very large range of stand conditions and includes trees that range in age from about 15 to 20 years to about 80 years. These stands have high rates of crown closure which tends to limit significant tree regeneration. In natural stands this stage is typically dominated by one or two tree species. Commercial thinning can be an effective management tool in both managed and natural stands in this structural stage. They can further reduce competition and increase average stand diameters. Shade tolerant understory trees and other plants may benefit from the increased light and respond with vigorous growth.

Understory Reinitiation - The vast majority of these stands have had no management and they were naturally regenerated. This stage is characterized by stands from 80 years old to 250 years old depending on site conditions. These stands have a dominant canopy layer and a secondary pole size understory layer.

Chart 2



Historical 1895 Vegetation



Legend

-  Project Boundary
-  Non-Forest
-  Initiation
-  Initiation/Exclusion
-  Stand Exclusion
-  Stand Exclusion
-  Old Growth/Reinitiation

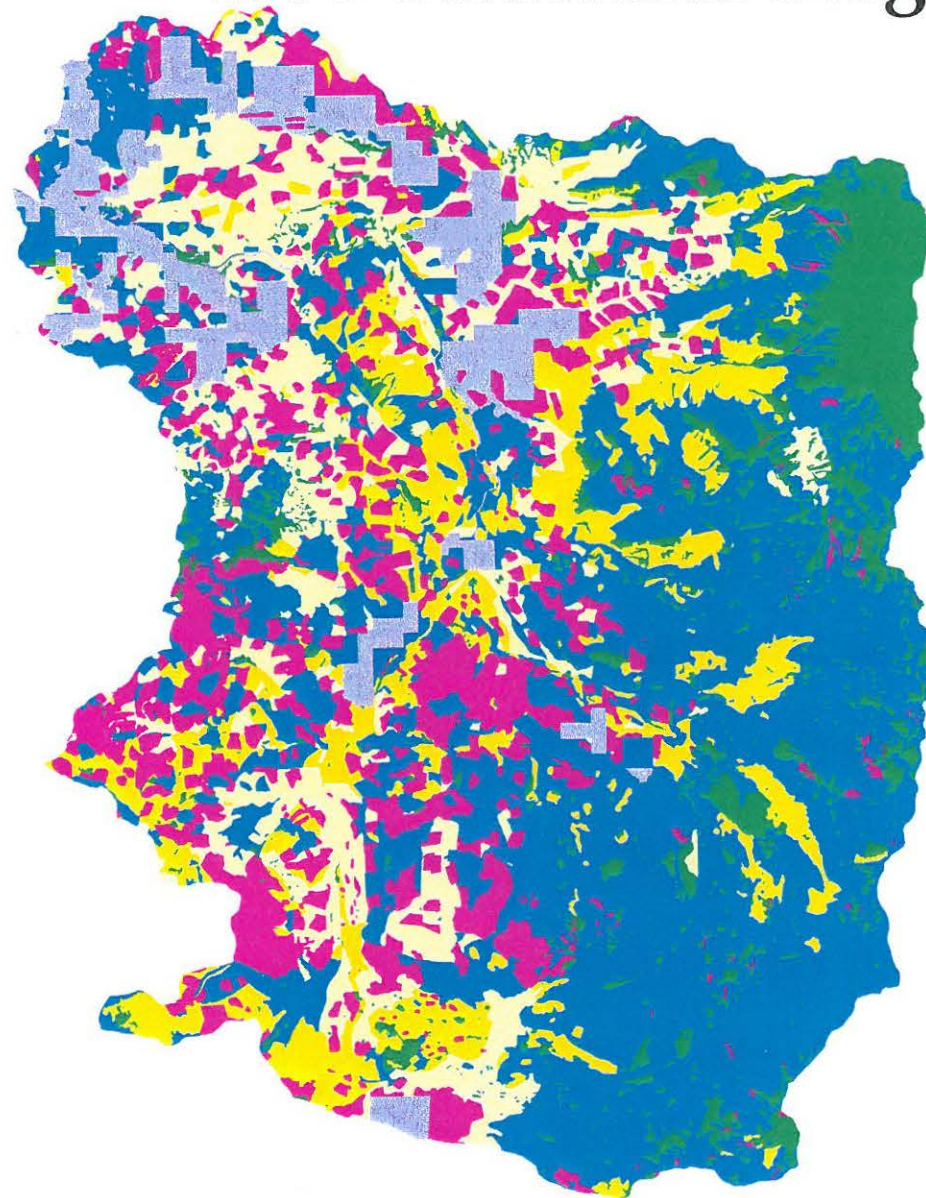


Upper North Santiam Watershed Analysis
Detroit Ranger District

Scale 1:200000
July 1995

Map #15

1995 Structural Stages



Legend

- Initiation
- Exclusion
- Reinitiation
- Old Growth
- Non-Forest
- Private



Upper North Santiam Watershed Analysis
Detroit Ranger District

Scale 1:200000
July 1995

Map #16

Past natural under burning has created these stands in many areas by killing sufficient over story trees and stimulating regeneration. It is generally felt that the watershed has experienced more under burning in the past than is generally recognized. Old salvage logging and recent commercial thins have resulted in the release of tolerant understory trees that are developing a second canopy layer at a much earlier age than would have developed under natural conditions. Fire suppression eliminated natural under burning.

Old Growth - These stands are generally the largest and oldest found in the watershed and can vary greatly by plant association series. They range from 200 to more than 600 years old. Based on existing data, more than 90% of these stands date back to the 1600's. In the oldest stands, especially those in the upper elevations, mortality and rots can be very high. Heavy competition from rhododendron, other shrubs, or beargrass can reduce tree replacement and leave natural stands in an open condition.

Changes in Stand Structure - The primary changes from historic conditions (1895) in stand structure for this watershed include a 17% reduction in stand initiation stands, a 24% increase in stem exclusion stands, and a 7% reduction in understory reinitiation and old growth stands.

Differences and Similarities Between Past and Current Condition - 1895 & 1995 Although the overall percentage structural stages are within the historic range of conditions, there are some differences between past and current conditions (see maps 15 and 16).

- Because of forest management practices, there are smaller openings now than in the past.
- Disturbances from fire within the watershed were episodic in the past rather than continuous with timber harvest and sustained yields.
- Tree reestablishment after disturbance was slower in the past than from current reforestation.
- Underburned conditions were common in the past. There is no comparable current condition other than shelterwoods.
- Understory initiation timeline sped up by thinning compared to natural timeframes.
- There is an increase in the abundance of shade tolerant species due to the lack of fire.
- Multi-species planning results in more species at an earlier age than is usually found in natural fire regenerated stands.
- Meadow and other special forest habitats are currently being encroached by conifers due to fire suppression.
- There are fewer snags and logs on harvest units in areas that have had long fire return intervals. There is less difference where fires were frequent.
- There is a higher fire hazard and fuel buildup from fire suppression activities in areas with short fire return intervals.
- There is higher spruce budworm mortality than in the past due to stand conditions resulting from fire suppression.
- Managed stands have more tree growth than natural stands at a comparable age.

The Role of Silviculture - Silvicultural techniques can be used to modify stand structure, growth and species composition. In addition to providing commercial forest products, another use for these techniques is the acceleration of late successional characteristics in Late Successional Reserves and Riparian Reserves (see recommendations). Success in developing late successional habitats will depend on the sites (see the Vegetation Report for more information about Vegetation / Physiographic Areas).

(VW3a) Highest Fire Risks in LSR: Map 17 indicates where the greatest risk from fire is likely to occur in the LSR. Major factors such as recent and historical fires, recent blowdown, and untreated slash were considered. Other contributing factors such as aspect, slope, and vegetation characteristics were considered but not mapped.

Barriers to Protecting LSR from Fires:

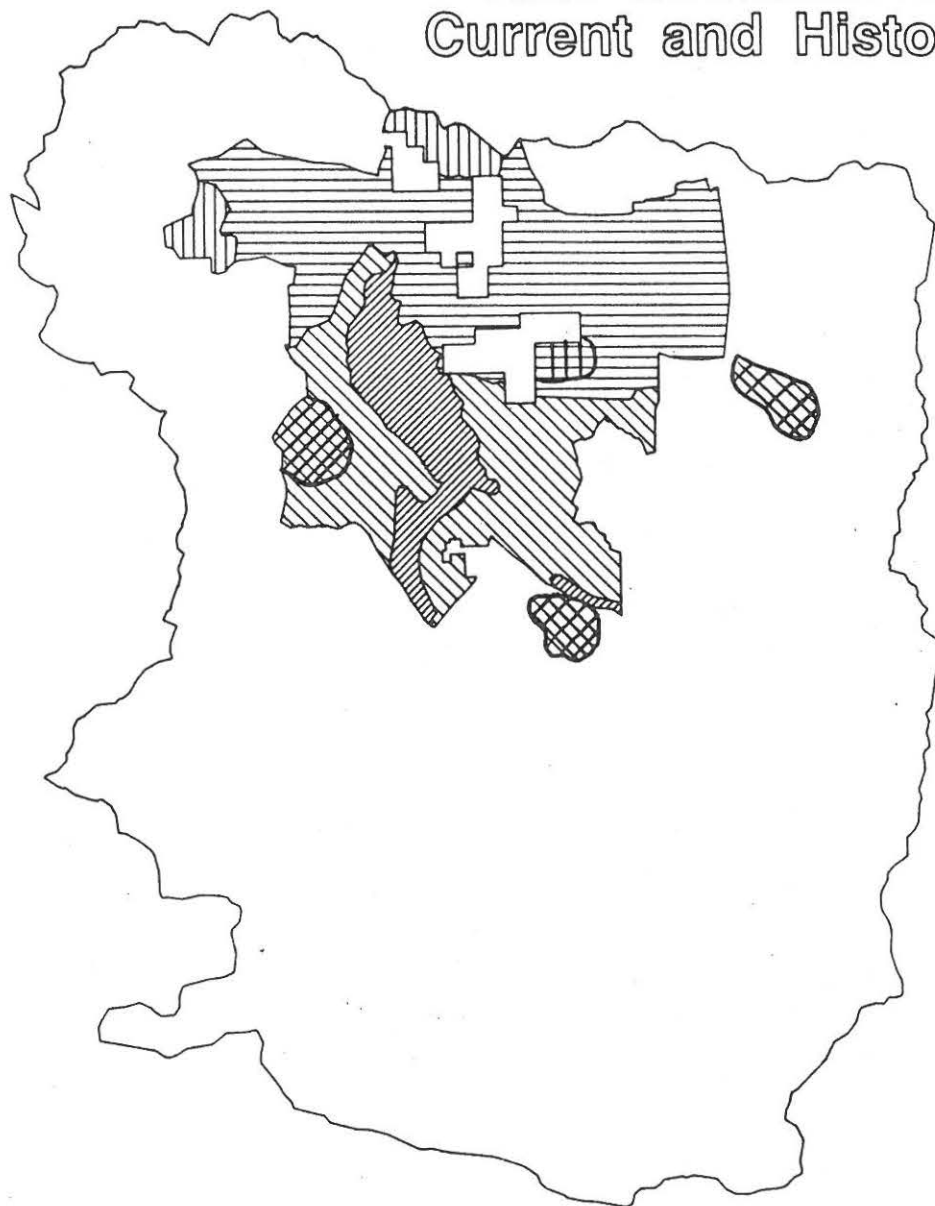
- Reduced road access as road maintenance budgets decline. Less need to keep logging roads open in an area with no programmed harvest.
- Significant areas of untreated blowdown from 1990 which may not meet 10 acre minimum sizes for treatment in an LSR.
- Risks of fire starting in the Mt. Jefferson Wilderness and moving into the LSR driven by east winds. Historical fire frequency and recent spruce budworm defoliation indicate a threat from the east. A limited ability to manage fuels in the wilderness constrains management options.
- Unburned harvest units, and snags and logs left in recent harvest units, will complicate suppression efforts when fires start or spread to these locations.

See Recommendations for opportunities to reduce fire risks.







Elk and Deer:

According to elk historical records, elk were well distributed in western Oregon. In the late 1800s year round market hunting nearly eliminated the elk population in the Santiam unit. By the early 1900s there were few elk in this area. Between 1909 - 1930s elk herds increased slowly without hunting. With an increase in logging after 1940s, herd numbers accelerated steeply with the increase in edge habitats. In the 50-70s elk were planted in isolated areas. Deer populations followed a similar pattern, except deer herds leveled out in the 80's and have remained relatively stable.

Late Succession Reserve Current and Historic Fire Risk



Legend

-  Low
Historic Fire Risk
-  Medium
Historic Fire Risk
-  Medium to High
Historic Fire Risk
-  High
Historic Fire Risk
-  High Fire Risk
Current
-  High Fire Risk
Current

Upper North Santiam Watershed Analysis
Detroit Ranger District

Scale 1:200,000
07/26/95

Map #

The increase in edge habitats from logging is the main contributing factor to large elk populations within the watershed today. As the number of roads within the watershed increased, so did hunter and poacher access resulting in decreased wildlife security. Timber harvest decreased the amount of big game cover.

(VW1k) Elk habitat effectiveness is below desired levels in 93% of the winter range and 57% of the watershed overall. Elk habitat effectiveness in terms of meeting current forest standards and guidelines is summarized in Table 14.

Table 14 - Proportion of Elk Emphasis Areas below Standards and Guidelines:

Elk Emphasis Areas	Habitat Effectiveness Elements				
	Road Density (HEr)	Cover (HEc)	Forage (HEf)	Size and Spacing (HEs)	Average (HEI)
Entire Emphasis Areas	21%	21%	21%	0%	57%
Winter Range only	71%	14%	21%	0%	93%

(VW1n) Current road densities affect wildlife populations: Road densities within the watershed range from 1-5 miles of road per square mile. The areas with the highest road densities are often within big game winter range. However, many of these have been closed for habitat protection in recent years, so current open road densities are generally lower. Road densities are highest in the Boulder Creek subwatershed at 4 miles of open road per square mile of habitat. Elk poaching occurs mostly in winter range where elk are concentrated. Road closures and law enforcement emphasis benefits herd health and hunting success.

Wildlife dispersal patterns often require movement across entire landscapes, such as with the wolverine, or as little as a few feet in the case of many salamanders. Barriers to dispersal block wildlife movements to adjacent habitats. Human disturbances from recreation or highway use are other forms of barriers, such as along Highway 22 and its associated dispersed recreation use.